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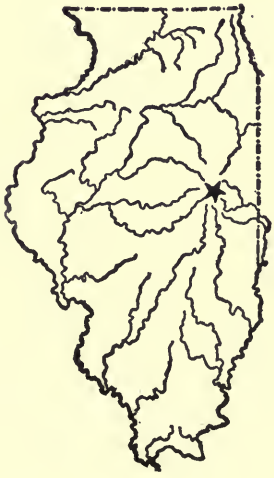
BULLETIN No. 269

THE MARKETING OF MILK IN THE CHICAGO DAIRY DISTRICT

By H. A. Ross



URBANA, ILLINOIS, JUNE, 1925

FOREWORD

If marketing conditions for agricultural products are to be improved, plans for improvement must be built on a solid foundation of ascertained facts, not upon opinion and guesswork. This bulletin describes many of the significant conditions surrounding the Chicago milk market, the present agencies for distribution, and the trend of consumption, with special reference to the problem of surplus milk.

It is the purpose of the Agricultural Experiment Station to collect and publish from time to time similar facts concerning other agricultural products. It is hoped that these will constitute a sound basis for the improvement of marketing facilities.

H. W. Mumford,
Director

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ACKNOWLEDGMENT

To the many agencies that furnished the mass of data embodied herein—producers' organizations, milk dealers, condenseries, creameries, cheese factories, railroads, meat packers—a word of acknowledgment is due. Special mention should be made of the courtesy of several milk distributing companies that supplied most of the detailed data. These companies not only opened their books to the investigator but were also generous in giving the time both of their executive and their accounting forces.

To the Illinois Agricultural Association, the Experiment Station is indebted for a part of the funds for this inquiry. The Association, realizing the need for a study of milk marketing conditions, made provision for a half-time research assistantship in dairy marketing at the University of Illinois for the year 1922-23, and the funds so provided were used to supplement those of the Experiment Station in carrying forward this investigation.

THE MARKETING OF MILK IN THE CHICAGO DAIRY DISTRICT

By H. A. Ross, Formerly Associate in Dairy Economy

INTRODUCTION

Almost all city milk markets at some time or other have experienced serious difficulties over the question of price. Producers usually believe that the prices they receive for milk are too low, particularly in relation to the prices paid by consumers. This belief has resulted in the formation of many cooperative marketing organizations, some of which have proved successful, while others have failed.

The Chicago market has not escaped the difficulties arising from price disagreements. Dissatisfaction among producers has been manifested by four milk strikes in the last nine years. Altho no strikes occurred during 1921 or 1922, dissatisfaction was especially strong at that time because the margin between the price paid by the consumer and the price received by the producer was unusually wide (Fig. 1). For many years the wholesale price to the producers amounted to about 40 percent of the retail price. From 1917 to 1920, wholesale prices rose more rapidly than retail prices (Fig. 2) so that the producer received about half the consumer's dollar. For the next two years, however, wholesale prices declined much more than retail prices and the farmer's share fell to about a third. Higher prices during 1923 and 1924 have brought back the ratio of earlier years.

The present investigation was undertaken with the twofold aim of analyzing the Chicago milk situation and of determining some of the fundamental facts underlying milk marketing. It was thought that past failures of cooperative marketing organizations were due in many instances to lack of knowledge of the economic principles involved. Much thought has been given in the past to the form of organization but, unquestionably, too little attention has been paid to obtaining the economic facts of milk marketing upon which to base sound marketing practice. This study, therefore, intentionally passes over the question of organization and deals only with the specific facts of marketing. It may be stated at the outset that no all-sufficing remedy for the ills of the situation is offered. Certain principles, however, are presented, based on a careful statistical analysis of the data, which may assist in the solution of the problems.

The data, obtained for the most part during the year October, 1922, to September, 1923, are of two kinds: (1) survey data obtained by the

issuance of questionnaires to all of the milk dealers in Chicago, and (2) detailed data taken directly from the books of a few dealers. Months of work in going over ledgers and other records yielded a large amount of material for study. All this has been analyzed and the results are presented in the various tables. Because of the keen competition between milk companies in Chicago, the dealers required that many of

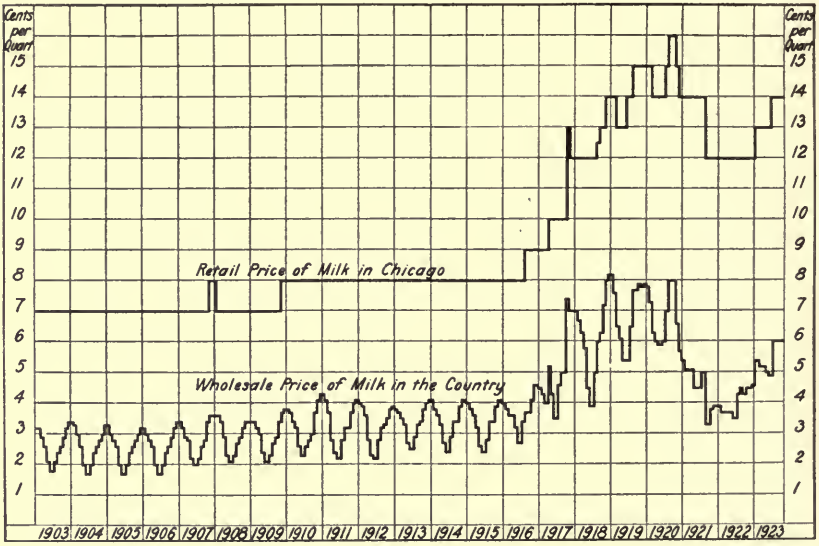

FIG. 1.—COMPARISON OF RETAIL PRICES OF MILK IN CHICAGO AND WHOLESALE PRICES PAID TO PRODUCERS AT COUNTRY PLANTS

Prior to 1916 the retail price of milk remained unchanged for long periods, while the price to the producers varied with the season and showed a slow upward trend. From 1917 to 1920 the wholesale price rose more rapidly than the retail price. When milk prices declined in 1920, the wholesale price fell more rapidly than the retail price, resulting in an unusually wide margin. (See Tables A and B, Appendix, for monthly prices.)

these figures be expressed as percentages, or in some form which would not divulge the identity of the companies or the facts relating to any individual business. Wherever possible, figures from different dealers have been combined, and it has been the writer's earnest endeavor to live up to the spirit of the agreement under which these valuable private records were made available to the public.

It has seemed advisable to include some descriptive and explanatory material about the Chicago market and the dairy district in order to give background to the study for those readers who may not be familiar with the region. With this exception, an effort has been made to leave out all discussion not bearing directly on the main subject.

The study is built about the problem of surplus milk. With this in view, production and consumption are first studied separately. Considerable attention is given to the demand side of the market, not because it is considered the most important, but because very little is known concerning it. The problem of surplus milk is next considered and this is followed by a brief comparison of the Chicago milk prices and prices of milk in the regions producing a surplus. Detailed tables not essential to the text are given in the Appendix.

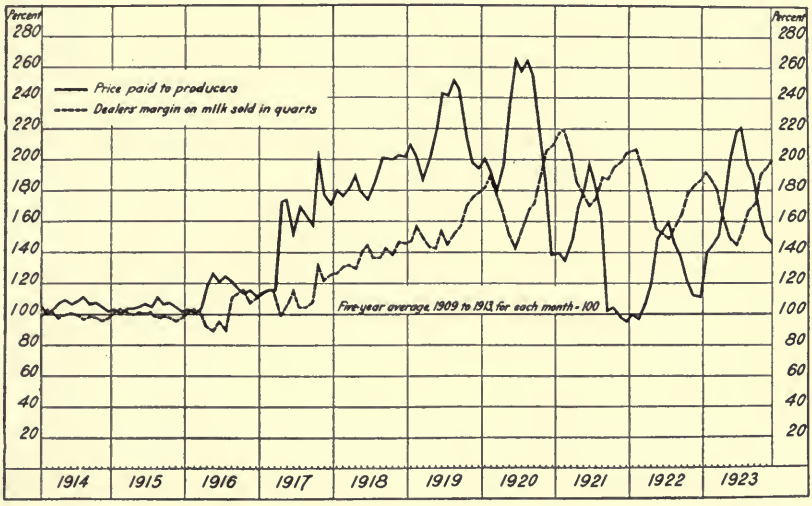

FIG. 2.—INDEX NUMBERS REPRESENTING PRICES RECEIVED BY PRODUCERS FOR ALL MILK DELIVERED AT COUNTRY PLANTS, AND DEALERS' MARGIN FOR HANDLING THAT PART OF THE MILK RETAILED IN QUART BOTTLES

From 1917 to 1920 the producer received about 50 percent of the consumer's dollar as compared with about 40 percent before the war. During 1921 and 1922 his share was less than the pre-war average. (See Tables C and D, Appendix, for monthly index numbers.)

THE CHICAGO MILK MARKET AND MARKETING AGENCIES

The demand for any commodity in a given market is determined by two factors: the number of people using the commodity and the amount used by each. In the case of milk, the first of these factors is measured approximately by the population of the city, because the use of milk is almost universal. The second factor, the amount used per person, is variable but, like wheat, the variation is far less than it is in the consumption of the less-essential foodstuffs. Hence, the probable increase in population may be taken to express roughly the probable increase in the demand for milk.

The dairymen in the Chicago district are fortunate as regards the prospect for increase of population, for the city gives every evidence of

continuing its rapid growth. Eighty years ago it was a village with less than 5,000 inhabitants. Today it is rapidly approaching the 3,000,000 mark (Table 1). If we include the numerous suburbs, which are really a part of the Chicago market, it seems probable that the 1930 Census will show approximately 3,500,000 milk-users in this great center.

In spite of the fact that the growing population of Chicago requires each year an increasing amount of milk to supply its needs, the number of milk distributors has been steadily decreasing. In 1915, according to the Department of Health, there were 1,260 milk depots and 5,671

TABLE 1.—CHICAGO AND SUBURBS AS A GROWING MARKET FOR DAIRY PRODUCTS
Total population, United States Bureau of the Census

Year	Chicago	Cook county
1840	4 470	10 201
1850	29 963	43 385
1860	109 260	144 954
1870	298 977	349 966
1880	503 185	607 524
1890	1 099 850	1 191 922
1900	1 698 575	1 838 735
1910	2 185 283	2 405 233
1920	2 701 705	3 053 017

stores handling milk.[1] By 1923 the number of depots had decreased to 575, while the number of stores handling milk had increased to 8,473.[2] The decrease in the number of distributors may be attributed largely to an order issued by the Commissioner of Health on July 22, 1916, requiring that, with the exception of certified milk, all milk sold or used in Chicago be pasteurized. Many small dealers without pasteurizing equipment were forced out of business. Others arranged to buy milk, already pasteurized and bottled, from the larger dealers. In a few instances companies were formed for the express purpose of pasteurizing and bottling milk for a group of independent distributors, few of whom operate more than one or two wagons. In 1923 there were 281 pasteurizing plants in Chicago as compared with 251 in 1915, 298 in 1916, 301 in 1917, and 270 in 1918.

Competition also has accounted for a part of the decrease in the number of dealers. The advantage which the larger distributors have in economy of operation and in facilities for handling surplus milk would tend to drive the one- or two-wagon dealers out of business were it not for the fact that in the small companies most of the labor required to handle and deliver the milk is furnished by the dealer and his family.

[1]Report of the Bureau of Food Inspection, Department of Health, City of Chicago, 1911-1918. Reprint Series No. 11, p. 893, 1919.

[2]Letter from Dr. J. P. Kilcourse, Chief, Bureau of Food Inspection, City of Chicago, August 29, 1923.

If the same rate had been paid for this labor as was paid by dealers dependent upon hired workers, the decrease in the number of distributors probably would have been more rapid than it has been.

An idea of the approximate size of the companies distributing milk in Chicago may be obtained from Table 2. The companies are here

TABLE 2.—VARIATION IN SIZE OF MILK DISTRIBUTING COMPANIES IN CHICAGO
Based on the number of wagons operated in 1923

Group	Number of wagons per dealer	Number of dealers[a]	Total number of wagons operated[b]
1	1	174	174
2	2	57	114
3	3	29	87
4	4	10	40
5	5	19	95
6	6 to 10	19	147
7	11 to 15	10	131
8	16 to 20	7	122
9	21 to 25	8	191
10	26 to 50	8	306
11	51 to 100	7	416
12	101 to 200	2	321
13	Over 200	2	2022
Total		352	4 166

[a]Several companies which were organized for the purpose of pasteurizing and bottling milk for a group of independent distributors have been considered here as dealers. The number of wagons operated is taken as the total operated by the sub-dealers making up each of these units.

[b]When a company operates wagons both in Chicago and the suburbs, the total number is included.

grouped according to the number of wagons each operates. Altho this is not an exact measure of the volume of business, it shows the great diversity in the size of the companies. These range from the dealer who receives a few cans of milk from near-by farms, which he bottles and delivers in the immediate neighborhood, to the company which buys milk at thirty-one country plants and uses over 1,300 wagons in distributing it thruout the city and in some of the suburbs. It may be noted that there is a decided discrepancy between this table and the report of the Department of Health as to the number of companies operating. The difference is due, in part, to classing as one company each group of independent dealers having a common bottling plant, as mentioned above.

TYPES OF MIDDLEMEN

Altho the many agencies handling milk in Chicago may be separated roughly into groups according to the general type of business they represent, no sharp lines of division can be drawn because of the overlapping of activities. For instance, almost all the large and many of the

small retail dealers have some wholesale trade. For the purpose of discussion, however, they will be classed here as: (1) retail distributors; (2) wholesale distributors; (3) stores; (4) jobbers; (5) brokers.

1. *Retail Distributors.*—The greater part of the milk sold in Chicago is handled by dealers whose chief aim is to supply the retail trade, but who also sell large quantities of milk at wholesale, either as bulk milk to hotels and restaurants or as bottled milk to stores, schools, industrial plants and the like. If the volume of wholesale trade is sufficiently large, special wagons or trucks are used to make deliveries. Otherwise, the wholesale business is handled on the retail wagons. Frequently the wholesale trade in a district is so small that it is more economical to pay the regular retail commissions to the drivers than it is to make a special delivery with a wholesale truck. As a result, the records of some companies are in a form which does not permit the separation of the retail and wholesale business.

2. *Wholesale Distributors.*—A few dealers make no attempt to enter the retail trade. They sell both bottled and bulk milk and cream to hotels, restaurants, and institutions using large quantities. By far the largest part of the wholesale trade in bottled milk, however, is with the stores. Since 1920, there has also developed a large demand for milk in half-pint bottles for school lunches. Altho this demand is seasonal, corresponding with the school term, the amount consumed in this way is a very appreciable part of the total milk consumption. The sale of milk to a school not only increases consumption directly, but it also serves as an excellent method of advertising the milk of the particular dealer supplying the school. Hence, this trade is perhaps more sought after than the profits warrant. Many offices and factories also buy considerable quantities of milk in half-pint bottles for their employees' lunches, and this trade, unlike that of the schools, continues thruout the summer.

3. *Grocery and Delicatessen Stores.*—Unlike some of the eastern cities, Chicago does not have stores dealing exclusively in dairy products, but milk and cream are commonly sold from grocery and delicatessen stores. The price of milk sold in this manner is usually the same as the regular retail price charged by the distributor. Even tho at most stores no saving is made, the amount handled in this way is very large, particularly during the summer. The corner grocery serves as a convenient milk depot to which the housewife can send for an extra bottle of milk to supplement the regular daily delivery. In addition, many families lacking ice in the summer time, depend on stores for the purchase of milk in small amounts just before it is to be consumed. The stores also get a large part of the trade of construction workers and similar groups of laborers, among whom there has been a great increase in the use of milk since the passing of the beer pail, altho large quantities are also purchased directly from retail wagons which make deliveries during the lunch hour.

Jobbing Companies.—These represent another type of middleman in Chicago. These companies sell milk, cream, and ice-cream mix to dealers or plants in Chicago and in various other cities. In fact, this business is not limited to near-by markets. During the summer, carload shipments of cream and ice-cream mix are sent regularly to distant points, such as Philadelphia, Memphis, and New Orleans. This milk and cream is ordinarily drawn from the distant parts of the Chicago dairy district, particularly from the regions producing a surplus. For instance, one of these companies is a subsidiary of a large condensed milk company and obtains its supply of milk from the condensing plants of the main company. These jobbers serve a useful purpose in providing a readily available supply for the distributors during the shortage season, when the regular supply from the country fails to meet the demand. In addition, many of the smaller dealers obtain cream from this source thruout the year, with the exception of a month or two during the spring when production is heaviest.

5. *Milk Brokers.*—Milk brokers, as indicated by the name, do not actually handle milk, but serve to find a market for individual farmers who wish to ship their milk directly to a dealer in the city. In the past, certain brokers also guaranteed collections for the farmers, thus insuring them against loss from irresponsible milk dealers. The business of these brokers is largely with the small dealers who have no country plants. In recent years, the producers' organizations have taken over most of the brokerage business formerly handled by privately owned companies. At no time has this method of selling milk in Chicago reached the proportions found in some city markets.

THE MILK DEALERS' BOTTLE EXCHANGE

The difficulty of complying with a Chicago ordinance which requires that a milk dealer use only bottles marked with the company's name is apparent when it is remembered that over four thousand wagons and twice as many stores are distributing milk in the city. The Chicago dealers have gone far towards solving the problem, however, by the formation of the Milk Dealers' Bottle Exchange, which began to function in a small way March 1, 1919, and came into full operation February 1, 1920.

The Exchange is a stock corporation owned by the milk dealers in Chicago in the proportion of one share of stock for each wagon operated. Approximately 90 percent of the dealers, who operate 98 percent of the wagons in Chicago, are stockholders in the Exchange and a number of dealers that are not members are served also. Most of the dealers have pledged themselves to use only their own bottles, altho the drivers are required to collect all empty bottles regardless of their ownership. The dealer sorts out the bottles belonging to other companies, and when these have accumulated in sufficient number they are picked up by a

truck from the Exchange. At the Bottle Exchange they are sorted and returned to their proper owners. Approximately 2,000,000 bottles are handled each month.[1] A cent and a half is charged for each bottle returned and the dealer receives three-fourths of a cent for each bottle sent to the Exchange. The difference (three-fourths of a cent) is sufficient to maintain the organization, and the expense to the dealers is very much less than the loss in bottles which resulted from the former disregard of ownership.

TABLE 3.—EFFECT OF BOTTLE EXCHANGE IN DISCOURAGING USE OF BOTTLES OWNED BY OTHER DEALERS

Group	Number of wagons per dealer	Number of dealers	Total number of wagons	Percentage of bottles *owned* by dealers using them		
				First inspection recorded[a]	Last inspection recorded[b]	Increase
1	1 to 5	285	500	49.6	73.1	23.5
2	6 to 15	31	282	71.6	88.4	16.8
3	16 to 35	16	360	86.2	92.8	6.6
4	Over 35	17	2 977	99.2	100.0	.8
All[c]		349	4 119	90.2	95.3	5.1

[a]Dates of first inspection range from May, 1922, to December, 1922.
[b]Dates of last inspection range from March, 1923, to May, 1923.
[c]Average percentages are weighted according to the number of wagons operated. The number of dealers and wagons do not quite correspond to the number shown in Table 2 because of incomplete records from which the above data were compiled.

Writs of replevin are used to recover bottles from dealers who refuse to abide by the agreement and from junk dealers who attempt to ship bottles from the city. Three inspectors are employed who visit the bottling plants and make a count of the bottles of other dealers which are being used. If these amount to a considerable number, the offending dealer is warned, and if this is not sufficient, a writ of replevin is served by the sheriff's office and the bottles are taken by the Exchange without allowing the dealer the usual three-fourths of a cent a bottle.

Before the formation of the Bottle Exchange, little attention was paid to the ownership of bottles, so that in a load of milk the majority of the bottles might bear names other than the name of the distributor. During that period many of the small dealers bought few or no bottles, but depended on those belonging to other dealers which their drivers collected. Certain junk dealers, also, made a practice of collecting milk bottles, which they sold to other dealers in the city or in neighboring cities. This practice became so flagrant that it was not uncommon to have a junk dealer approach a distributor and offer to sell back to him some of his own bottles.

Since the formation of the Milk Dealers' Bottle Exchange, the

[1]Table E, Appendix.

bottle situation in Chicago has improved greatly. Records are not available for the first year of operation during which the greatest improvement was observed, but Table 3 shows that even during the last year (1922-1923) the proportion of the other dealers' bottles in use has decreased appreciably. It will be noted that the smallest dealers are in general the worst offenders, tho many one- and two-wagon distributors have as good records as have the large companies and are using no bottles but their own.

A milk-can exchange for wholesale dealers is also in operation in Chicago, but it is not functioning so successfully as the Bottle Exchange. This is due, in part, to the greater value of the cans, the ease of obliterating the owner's name, and the wide territory covered by can shipments.

THE CHICAGO DAIRY DISTRICT

In the preceding pages an attempt has been made to picture roughly the Chicago milk market and the agencies which span the gap between the producers and the consumers of milk. In the following pages an attempt is made to present a similar picture of the Chicago dairy district and the milk producers.

With the growth of the Chicago milk market there has naturally been a corresponding expansion of the dairy district supplying the market. This expansion has been in the nature of rapid and irregular developments along certain railroads or in particularly favorable areas, rather than a uniform extension of the outer limits of the milk zone. Moreover, this uneven boundary of the milk zone advances or recedes with seasonal variation in production. Many plants in the more distant parts of the district hold shipping permits from the Department of Health and ship fluid milk into Chicago during the season of shortage, but condense or otherwise utilize the milk during the rest of the year.

The direction in which the Chicago milk district is growing is quite apparent. To the south, corn-growing appears to be the most profitable type of agriculture and dairying has made little headway in that direction, but to the west, and more particularly to the north, dairying is well established. The only question here is one of a market. Will the milk now being produced in these regions be condensed, made into butter or cheese, or be shipped in natural form to Chicago? The answer to this question is of the greatest importance to the dairymen now supplying the Chicago market.

REGIONAL PRODUCTION OF MILK AND TRANSPORTATION COSTS

McHenry, Lake, Kane, and DuPage counties in Illinois are usually thought to represent exceptionally heavy milk-producing areas because they constitute the inner or most intensive part of the Chicago dairy district. More milk, however, is produced per square mile in Calumet and Sheboygan counties, Wisconsin, than is produced in McHenry

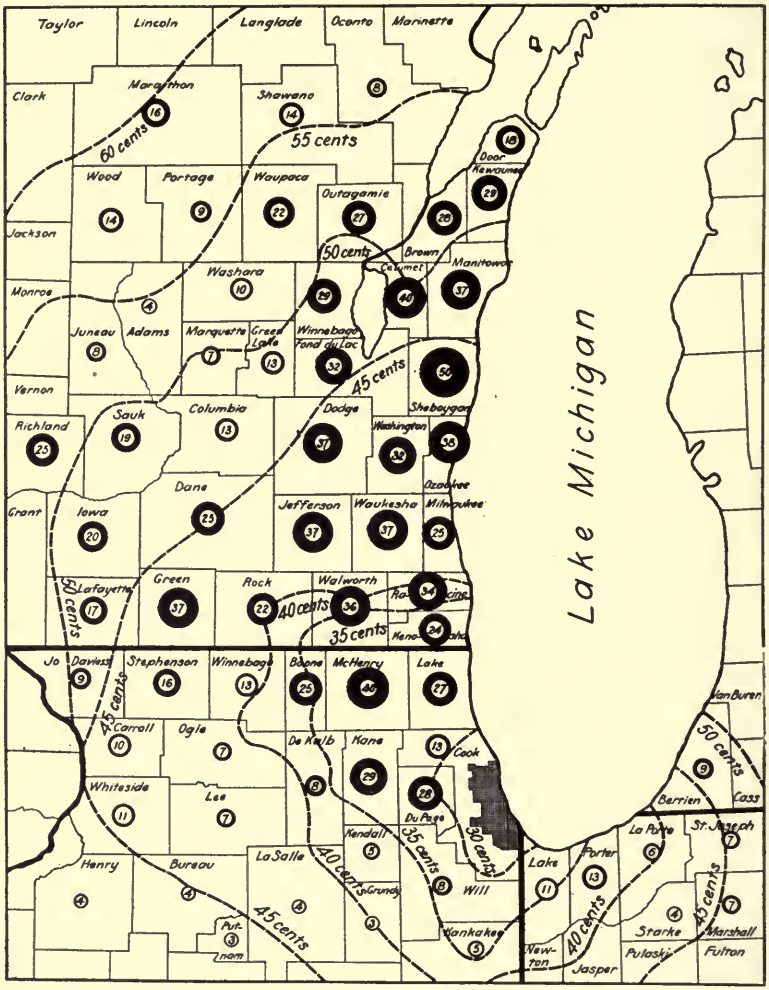

FIG. 3.—PRODUCTION OF MILK IN THE CHICAGO DAIRY DISTRICT

Each figure represents the number of thousands of gallons produced per square mile in the county, according to the 1920 Census. The cost, per 100 pounds, of shipping milk to Chicago in 10-gallon cans is indicated by the dotted lines forming the outer limits of the rate zones. Note the heavy production of milk in the zone bounded by the 40- and 45-cent rate lines. Most of this milk is now condensed or made into butter or cheese, but it can be shipped to the Chicago market at a cost only slightly greater than the cost of shipping milk from the present dairy district. Milk can be shipped in tank cars from this region at less cost than milk in cans from the near-by district.

county, while a dozen counties in Wisconsin show a heavier production than Lake, Kane, or DuPage counties (Fig. 3).

The great volume of milk produced in the outer zones of the Chicago area has already been tapped for the Chicago market, and larger and larger amounts will be drawn from it in the future as the city market grows. If the extension of the Chicago dairy district proceeds at a rate just sufficient to meet the needs of an increasing population, the development will be sound. If, however, high fluid-milk prices or any other factors cause the outer zone to change too rapidly from a dairy manufacturing region to a milk shipping region, the dairymen supplying Chicago at the present time will suffer, because the city market cannot possibly absorb the milk they are producing and that now being produced in the more remote regions.[1]

The cost of shipping milk to Chicago from different parts of the accessible milk-producing area is indicated by the dotted lines on the accompanying map (Fig. 3). The line shown is for 100 pounds of milk in 10-gallon cans. These lines were located by connecting the different shipping stations having the same rates for milk. Some points located on branch lines within the various zones have higher rates than the zone lines indicate, but, in general, the cost of shipping milk to Chicago is correctly portrayed.

At the present time, by far the largest part of the milk entering Chicago comes from within the zone bounded by the transportation rate of 40 cents per hundred pounds. Practically double this amount of milk is produced in the territory bounded by the 45-cent rate line. In other words, *the payment of only 5 cents a hundred pounds additional opens up a territory producing a larger amount of milk than is produced within the 40-cent zone.* Not all the milk produced between the 40- and 45-cent rate lines is available for the Chicago market, for the district supplies Milwaukee and numerous smaller cities. Some of it, however, is already going to Chicago. Tho much of it is of sufficiently high quality to be diverted to the fluid-milk market, the bulk of it is now condensed or made into cheese and butter, approximately thirty-five condensing plants being located within this zone (Fig. 4). The Swiss cheese industry, centering in Green and LaFayette counties, Wisconsin, has even higher requirements relative to the acidity of milk when delivered to the country plant than does the fluid market, and this milk can easily be made to meet the requirements of the Chicago Department of Health.

Another factor that may influence the development of the Chicago dairy district is the tank car. At least twenty-five of these cars have been purchased by four or five dealers and in all probability more will be put into use. The capacity of the tank car is approximately 51,000

[1]Since writing the above, the prediction has been fulfilled. High prices in the summer of 1924 attracted Wisconsin milk and cut many producers in the inner district out of a market.

pounds, or more than twice the capacity of the usual car loaded with 10-gallon cans. Because of this fact, relatively low transportation rates

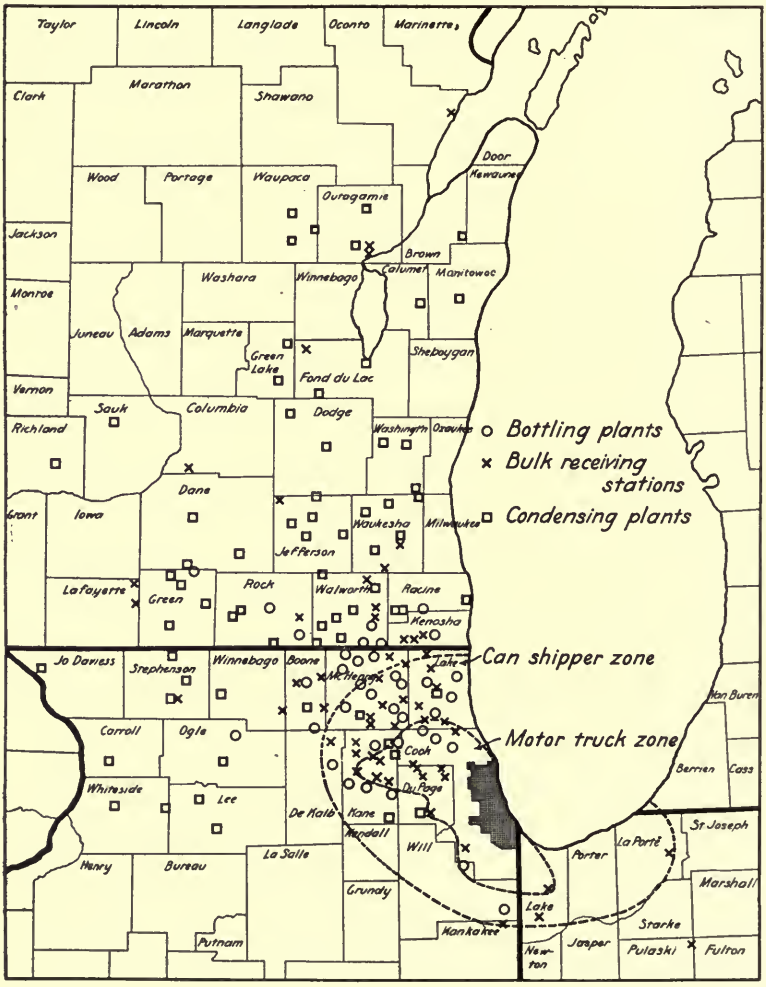

FIG. 4.—LOCATION OF COUNTRY PLANTS IN THE CHICAGO DAIRY DISTRICT

Most of the bottling plants are located in the inner district because of the higher cost of shipping bottled milk. Condensing plants tend to cluster about the margin of the dairy district, altho a few are to be found close to Chicago.

have been granted by the railroads. For instance, the quoted rates for milk transported from Slinger, Wisconsin, to Chicago (a distance of 125 miles) reduced to a hundredweight basis are as follows:

Milk in tank cars.....27 cents
Milk in 10-gallon cans.....45 cents
Milk in 8-gallon cans.....49 cents
Milk in bottles.....72 cents

With the low rate for tank cars, milk can be brought long distances at less expense than it can be shipped short distances in cans. Not all dealers, however, can take advantage of this saving in transportation. In the first place, only comparatively few city bottling plants are located on railroads, and the necessity of transferring the milk in tank trucks from the car to the plant offsets a part of the advantage in their use. In the second place, the quoted rate is based on a minimum load of 40,000 pounds, and relatively few country stations supply this amount thruout the year. It is of course possible to load a tank car at more than one station, and both this and the first objection could be met by the use of the compartment tank car.

In the third place, the investment involved seems too large to many of the smaller dealers. This factor is of no particular consequence, however, when compared with the saving in the cost of transportation if a sufficient volume of milk is available. The initial cost of the cars is high,[1] but the upkeep is far less than that of cans sufficient to handle an equal amount of milk.

The present tendency in the use of tank cars is to draw milk from well-established country plants in the regular Chicago district, and so long as this is continued tank cars will be an advantage to the producers of the inner district as well as to the dealers. They make it possible, however, for dealers to go far up into the surplus regions and obtain milk not now reaching the Chicago market, for the cost of transporting milk from these regions in tank cars is less than the can rates from the near-by shipping stations.

FACTORS TENDING TO RETARD THE EXTENSION OF THE CHICAGO DAIRY DISTRICT

The economic position of the dairymen located in the inner dairy district and producing milk for the Chicago market might be considered very insecure, because of the great surplus milk-producing region which adjoins on the north, were it not for certain factors which tend to maintain the present district. These factors are: the large investment in country plants, the limitations of direct shipments of milk, and the increased use of motor trucks in the district.

Large Investment in Country Plants.—A very large amount of milk used in Chicago is bottled in country plants. These bottling plants, approximately forty in number, are scattered thruout the principal parts of the dairy district, as shown in Fig. 4. Altho owned by but six companies, these six companies operate over half the wagons in Chicago.

[1] The quoted price in March, 1924, for a complete car was $13,500.

The milk received at these plants is pasteurized, bottled, and shipped to the city in refrigerator cars. As each of these country units is a complete milk plant and usually includes equipment for the utilization of surplus milk, a very large investment is represented by the combined group. For this reason, any shift in the dairy district which would mean the abandoning of these plants would, if possible, be avoided. At the same time, should a producing area be opened which would permit competing dealers to purchase their supplies at decidedly lower prices than those prevailing in the locality of the country plants, the companies owning the country plants would be forced to meet the competition.

In addition to the large amount of capital represented by these bottling plants there is also a very heavy investment in country plants where milk is received, cooled, and shipped to the city bottling plants. Altho the usual method is to ship the milk in 10-gallon cans in refrigerator cars, some variations are to be observed, such as the use of 8-gallon cans and the tank cars previously mentioned. In a few instances tank trucks are used to transport the milk from the nearest receiving stations. As may be seen by Fig. 4, many of these plants are located much farther from the city than the bottling plants. This is to be expected, because the transportation rates for the bottled milk are from 50 to 70 percent greater than for milk in 10-gallon cans. This relatively high transportation rate and the increasing use of motor trucks and tank cars may foreshadow the conversion of many of the country bottling plants into bulk receiving stations. In the past, the higher cost of shipping bottled milk was offset to a certain extent by lower labor costs in the country plants, but this advantage was lost when the country workers in the inner district were unionized.

Probably the most distant country plant of a Chicago dealer is located at Oconto, Wisconsin, approximately 230 miles from the city. Other isolated spots in the great surplus producing region from which milk is regularly shipped are: Appleton, 184 miles; Ripon, 168 miles; Fond du Lac, 148 miles; and Plymouth, 151 miles. It is from similar points outside the main district that the jobbers usually draw their supply of milk and cream.

It is a peculiar fact that until very recently no difference was made in the price paid for milk at the various country plants in the main Chicago district regardless of the freight charges. Since the dealers buy on average costs of transportation, the near-by dairyman with higher production costs has been penalized by having to pay a portion of the transportation costs of the milk produced in the more distant parts of the district. It is surprising that a practice so illogical and uneconomic as this one has persisted for so many years, particularly with the can-shippers in the same territory operating under what amounts to a zoning system. At the present time a premium of 8 cents a hundred pounds of milk is paid at a few of the nearest country plants and it is to be hoped that the practice will be extended until all milk purchased

at country plants will be subject to a differential at least as great as the difference in freight rates. If such a system of buying is put into effect it will tend to retard the extension of the dairy district by giving to the near-by dairymen the differential in price which is economically justified by their nearness to market.

Limitations of Direct Shipments.—Of the 575 dealers in Chicago, only about forty have country plants. The rest obtain their milk in one or more of the following ways: by purchases from other dealers, by truck from the country, or by direct shipment in cans from individual dairymen. The last method is also employed to some extent by certain of the dealers having country plants. This milk is shipped in 8-gallon cans and is ordinarily handled without ice in regular baggage cars.

The can-shippers receive, in addition to the regular milk price, an allowance of 15 cents a can if they furnish the cans. They pay the cost of transportation and are allowed about 23.5 cents a can by the dealers to cover this cost. The amount allowed for transportation is equal to the freight rate from points approximately fifty miles from Chicago. If the shipper lives nearer the city, he profits by the arrangement to the extent of the difference between the rate allowed and what he actually has to pay. This fact, together with the lack of refrigeration, has tended to limit the can shipments to a zone with a maximum radius of about 75 miles. Were it not for these two factors, many dairymen in the outer zone who are now selling to condenseries or cheese factories would ship directly to small dealers in the city.

The approximate number of can-shippers sending milk to Chicago over the principal railroads in the spring of 1923 was obtained by the Milk Producers' Association. The number reported by the various roads was as follows:[1]

Chicago, Milwaukee and St. Paul	500
Illinois Central	292
Pennsylvania	250
Chicago Great Western	150
Chicago, Burlington and Quincy	116
Chicago, North Shore and Milwaukee	62
Aurora, Elgin and Chicago	60
Grand Trunk	55

The Chicago and Northwestern and the New York Central were unable to give the desired information. Mr. E. C. Rockwell, Secretary of the Milk Producers' Association, estimated, however, that about 250 farmers were shipping over the Chicago and Northwestern, but that only a very few were sending milk over the New York Central. The Atchison, Topeka and Santa Fe and the Chicago, Rock Island and Pacific reported that the milk business over their lines was handled by

[1]Letters from Mr. E. C. Rockwell, Secretary, Milk Producers' Association, July 11, 1923, and October 11, 1923.

the American Railway Express Company, so it may well be assumed that the volume of milk handled over these lines is light. The Chicago and Eastern Illinois and the Michigan Central reported no farmers shipping.

The number of can-shippers in the Chicago district may be estimated from the preceding figures at something less than 2,000. There are undoubtedly far fewer at present than there were a few years ago, a large falling off having resulted from the introduction of the motor truck. It is highly probable that the number will continue to decrease as the use of motor trucks increases.

Increased Use of Motor Trucks.—Within the last decade there has been a rapid development in the use of motor trucks to transport milk from the country to Chicago. As the hard road system is extended, this method of transportation will become increasingly important in that part of the district which is near enough the city to make its use practicable. Truck hauling has certain advantages over rail transportation and producers in the inner district thereby enjoy an additional advantage over those in the more remote zones.

In July, 1923, a survey[1] of the dealers indicated that at least 75 trucks were being used to pick up milk in the country. Data on about 40 of these showed that they were hauling a total of about 280,000 pounds of milk each day, but as this was the season of light production practically all dealers reported that much heavier loads were hauled during the rest of the year. In addition to these trucks hauling milk in cans, seven tank trucks were reported as bringing in about 100,000 pounds of milk daily from bulk receiving stations. Some of these trucks made two trips a day.

The trucks which pick up the cans of milk at the farms or from stands along the truck routes are commonly of 3.5 tons capacity but usually carry an overload. The number of cans hauled varies with the season and the size of the truck, 100 cans being a fair average for trucks of this size. Table 4 shows the range in the size of loads during the period of shortage. During the surplus season, however, as many as 160 cans are hauled on a single truck. Loads in excess of the weight limit set by the state road law[2] are common and arrests for violations are not infrequent. This is particularly true in the case of four-wheeled glass-lined tank trucks of 1,500 gallons capacity.

The average distance milk is hauled by the can trucks is about twenty-five to thirty miles, altho one truck was reported as hauling milk from a point fifty miles from the city. The mileage of 16 trucks haul-

[1]Data collected by Mr. H. F. Hall of the Department of Dairy Husbandry, University of Illinois.

[2]The maximum weight allowed for vehicle and load is 24,000 pounds, or 32,000 pounds if trailer or semi-trailer is used. In either case, the weight on one axle cannot be more than 16,000 pounds.

ing milk for 9 different companies is shown by Table 5. Because of the greater amount of milk hauled, tank trucks are more economical for long hauls than are the can trucks, but the tank trucks require country plants where the milk can be cooled and are therefore not used by the smaller dealers.

In most instances milk dealers do not own the trucks, but pay the trucking company an agreed price per can, which usually corresponds

TABLE 4.—NUMBER OF EIGHT-GALLON CANS OF MILK HAULED PER TRUCK

Group	Number of cans per truck	Number of trucks	Percentage of total number of trucks
1	81 to 90	11	50.0
2	91 to 100	1	4.5
3	101 to 110	4	18.2
4	111 to 120	2	9.1
5	121 to 130	2	9.1
6	131 and over	2	9.1
Total		22	100.0

to the rate for rail shipments. Table 5 indicates the cost of the two methods. It must be remembered that with rail shipments most dealers have the additional cost of trucking the milk from the unloading platforms in Chicago to their bottling plants. With truck hauling this cost is avoided. Even with the plant located on a railroad, the latter method permits greater convenience in unloading if the dealer arranges for his trucks to arrive at different times. This avoids the peak load of labor which occurs upon the arrival of the milk train.

TABLE 5.—DISTANCES MILK IS HAULED BY MOTOR TRUCK AND RATE CHARGED PER EIGHT-GALLON CAN

Company	Number of trucks	Mileage one way	Rate per 8-gallon can	
			Motor truck	Rail shipment
		miles	*cents*	*cents*
1	4	23	21	21
		25	21	21
		26	21	21
		30	21	21
2	2	30	24	24
		35	30	30
3	2	35	25	25
		50	28	28
4	1	31	21	21
5	1	21	20.5	20.5
6	1	20	20.5	20.5
7	2	32	25	24
8	1	25	20	21
9	1	28	25	25
Average		29.3	23.1	23.1

No data were available on the cost of operating tank trucks, altho one dealer reported a contract with a trucking company operating two trucks, each having a capacity of 1,500 gallons. The trucking company owned all transportation equipment and assumed all road responsibility. The rate charged was 30 cents a hundred pounds for a 50-mile haul. The rail rate from this country plant was 33 cents a hundred pounds. In addition to the saving in rates by tank trucks, the dealer avoided the cost of cans and the cost of trucking the milk from the unloading platform in the city to his bottling plant.

With the present high transportation rates it would appear that where tank trucks or tank cars can be used, the logical thing to do is to convert the country bottling plants into bulk receiving stations and avoid the cost of hauling bottles back and forth between country and city.

There is every reason to believe that the trucking of milk to Chicago will increase, and to the extent that trucks lower the cost of transportation or add to the convenience of the dealers, the near-by producers will have an advantage over the more distant dairymen and the extension of the district will thereby be retarded.

INTENSITY OF DAIRYING IN THE INNER AND OUTER PARTS OF THE CHICAGO DAIRY DISTRICT

Some idea of the intensity of dairying in the Chicago district may be obtained from figures based on a census of 3,406 dairy farms.[1] These farms show the greatest variability in character and organization. The range is from small to large farms, from scrub cows to record-breaking and prize-winning purebreds, from the keeping of a few cows as a side line to the maintenance of very large herds and the employment of intensive methods. The variation is not great enough, however, to lessen the significance of these figures showing the average dairy farm unit from which Chicago's milk supply is obtained. In Table 6 these figures have been grouped to show the differences between the average farm in the inner, or the most intensive part of the district, and the average farm in the outer but not the most distant region.

There is no significant difference between these two regions in the size of farms or in the percentage of tenancy. The greater intensity of dairying in the inner district is shown, however, by the larger size of the herds maintained—20 cows and 6 heifers as compared with 13 cows and 4 heifers in the outer district. The ratio of heifers to cows is one to three in both regions. The predominance of the latter is too great to maintain the herds without the purchase of some additional cows. The annual production of milk per cow, as indicated by the sale of milk, is 700 pounds higher in the inner district. The farms in the latter region are also better equipped, as is shown by the number of silos, milking machines, and power pumps.

[1]Taken biennially by company inspectors.

Undoubtedly greater differences would be observed if the comparison were made between the farms of the inner district and those on the margin, but the latter would represent but a small part of the source of supply.

TABLE 6.—COMPARISON OF AVERAGE DAIRY FARM IN INNER, OR MOST INTENSIVE, PART OF CHICAGO DAIRY DISTRICT AND AVERAGE DAIRY FARM IN OUTER PART OF DISTRICT, 1922

Section of dairy district	INNER	OUTER
Counties included	Cook, Lake, Kane, and McHenry, Ill.	Will, DeKalb, Ogle, and Boone, Ill.; Kenosha, Rock, and Green, Wis.
Total number of milk plants or stations included	20	10
Total number of dairy farms included	1 863	1 543
Percentage of dairymen that are tenants[a]	40	46
Percentage of dairymen that are owners[a]	60	54
Average number of acres per farm	136	131
Average number of cows per farm (milking)[b]	16	10
Average number of cows per farm (dry)[b]	4	3
Average number of cows per farm (total)	20	13
Average pounds of milk sold daily per cow (milking)[b]	23	22
Average pounds of milk sold annually per cow (total)[c]	5 701	4 997
Average number of heifers per farm (over 1 year)[b]	3	2
Average number of heifers per farm (under 1 year)[b]	3	2
Average number of heifers per farm (total)	6	4
Average number of silos for each 100 farms	90	74
Average number of milking machines for each 100 farms	19	13
Average number of power pumps for each 100 farms	72	64

[a]The percentage of tenancy for the outer district is based on data obtained from seven country plants instead of ten.

[b]At the time the data were collected, May, 1922.

[c]Obtained by dividing the total amount of milk sold in 1922 by the total number of cows on the farms in May, 1922.

MILK PRODUCTION IN THE CHICAGO DAIRY DISTRICT

In order to understand the situation which exists today in the Chicago milk market it is necessary to examine the events of the last few years which have brought about the present conditions.

Dairying is much more sensitive to economic changes which affect its relative profitableness than is the growing of crops. For instance, if the price of corn suddenly advances until it is relatively much higher than the price of wheat, the acreage of wheat cannot be decreased nor the acreage of corn increased until the next planting season. On the other hand, if the price of corn advances until it is relatively much

higher than the price of milk, the dairy farmer can immediately make an adjustment in his business. He can feed a lighter ration or send some of his poorest cows to the stockyards and sell the corn which would otherwise have been turned into milk. In either case, the production of milk is decreased. This is exactly what happened during the period of the war.

VARIATION FROM YEAR TO YEAR

In September, 1917, the price of corn[1] was approximately 200 percent higher than the pre-war average. Milk, however, was only 59

TABLE 7.—VARIATION IN AVERAGE AMOUNT OF MILK SOLD ANNUALLY PER FARM
Note temporary decrease in production of milk during the period of the war

Year	Number of farms	[a]Average amount of milk sold anually per farm	
		lbs.	*perct. of 1913*
1913	1 549	89 800	100.0
1914	1 740	94 600	105.3
1915	1 853	95 400	106.2
1916	1 988	93 000	103.6
1917	1 897	83 400	92.9
1918	1 722	73 700	82.1
1919	1 727	85 300	95.0
1920	1 741	86 800	96.7
1921	1 773	92 400	102.9
1922	1 833	96 400	107.3

[a]Based on the average sales to eighteen country plants. The same plants are used thruout the entire ten-year period.

percent higher. This was probably the month of greatest difference in the price of milk and corn, but the continued high price of feed and labor made dairying *relatively* unprofitable for some time. The result was a *curtailment* in the amount of milk produced. Many dairymen actually discontinued the business, but the greatest decrease in production came from the sale of a part of their cows and the lighter feeding of the rest by those men who remained in the business.

Table 7 shows the extent of this decrease in production. From 1913 to 1916 the average sale of milk to eighteen country plants by some 1,800 farmers ranged from about 90,000 to 95,000 pounds of milk yearly per farm. In 1917 the amount dropped to about 83,000 pounds and in 1918 to less than 74,000 pounds. The total number of farmers selling milk to these plants also decreased during this period, but it must not be concluded that all the dairymen who discontinued selling to these plants sold their cows; undoubtedly, some of the number merely changed to direct shipments or to trucking, which was rapidly gaining favor.

[1]No. 2 yellow corn at Chicago.

Per capita consumption of milk also declined during this period, but not to the same extent as production. The increase in population tended to offset the decreased consumption and the dealers were faced with the necessity of obtaining approximately the usual amount of milk. Since the production per farm was low (less than four-fifths as much as the four-year average, 1913 to 1916) additional territory had to be opened. Plants were started in many new localities in 1918 and the dairy district advanced farther into the surplus producing region. The next year, however, the production of milk in the old territory was about 15 percent greater than in 1918, and by 1922 it was 31 percent higher than before the war-time slump. This large increase in the amount produced in the old territory and the large supply of milk coming from the new territory made it inevitable that a tremendous surplus would result.

That these changes in production per farm were due both to variations in the size of the herds and to changes in the rate of feeding is shown by Table 8. The average number of cows per farm in 1918 was 12.6 percent less than in 1913. The production of milk per cow also decreased 6.5 percent during the same period. By 1920, higher milk prices had resulted in increases over 1918 in both the size of the herds and in the average production per cow. Very low prices for milk during 1921 and 1922 not only checked the increase in the average size of herds, but even resulted in a slight decrease in 1922. The production of milk per cow, however, was greatly increased, because the farm value of grain and hay was relatively lower than milk. Even with the prevailing milk prices, dairymen found it profitable to market as large a proportion of their crops thru the cows as was possible.

This table suggests the reason why prices of dairy products do not exhibit well-defined cycles such as are shown by prices of beef cattle, hogs, and horses. Prices of these classes of livestock tend to rise and fall over a period of years with considerable regularity because of alternate periods of over- and underproduction. In all probability, there are similar periods of over- and underproduction of dairy cattle, but the production of milk is not directly determined by the number of cows since changes in the rate of feeding may offset changes in the number of cows. Thus, the average size of a herd in the Chicago district in 1922 was only 1 percent greater than in 1918, but the production of milk per cow was 29 percent greater. The relative elasticity of the two factors is indicated by the coefficients of variability for the data covering these six years.

Average number of cows per farm.....5.93 ± 1.15
Average production of milk per cow.....8.83 ± 1.72

The effect of economic conditions is also shown in the number of heifers kept on these farms. 1916 showed an increase over 1913, but the unfavorable outlook for dairying in 1917 and 1918 resulted in the keeping of fewer heifer calves. The average number of heifers over one

TABLE 8.—CHANGES IN NUMBER OF DAIRY CATTLE PER FARM AND IN PRODUCTION OF MILK PER COW DUE TO ECONOMIC CAUSES
Based on surveys of all farms selling milk to fifteen country plants in Chicago dairy district

Year	Number of farms	Average number of dairy cattle per farm						Average annual production of milk per cow[b]	
		Cows		Heifers over one year old		Heifers under one year old			
		No.	*perct. of 1913*	*No.*	*perct. of 1913*	*No.*	*perct. of 1913*	*lbs.*	*perct. of 1913*
1913	1 409	18.3	100.0	4.3	100.0	4.1	100.0	4 616	100.0
1914[a]	.....	.....	.....	.....	.....	.....	.....	.....	.....
1915[a]	.....	.....	.....	.....	.....	.....	.....	.....	.....
1916	1 923	18.5	101.1	4.6	107.0	4.7	114.6	4 840	104.9
1917	1 911	18.2	99.5	4.4	102.3	3.7	90.2	4 360	94.5
1918	1 792	16.0	87.4	3.3	76.7	2.7	65.9	4 316	93.5
1919[a]	.....	.....	.....	.....	.....	.....	.....	.....	.....
1920	1 774	17.0	92.9	2.8	65.1	2.3	56.1	4 918	106.5
1921[a]	.....	.....	.....	.....	.....	.....	.....	.....	.....
1922	1 900	16.2	88.5	2.5	58.1	2.5	61.0	5 569	120.6

[a]Data not available.
[b]Total amount sold to plants divided by total number of cows on farms.

year old in 1918 was 23.3 percent less than in 1913, while the average under one year old was 34.1 percent below. The number of heifers continued to decrease even thru the period of high milk prices (1918, 1919, and 1920), and only a slight increase is shown for heifers under one year old, in 1922. It is to be expected that a certain amount of lag behind milk prices would be found, but the long continued decrease in the raising of heifers indicates other restraining factors. The very poor market for dairy cattle during 1921 and 1922 permitted the purchase of excellent cows at low prices and this undoubtedly tended to discourage the raising of young stock. It is possible that this period may mark a permanent change in the method of maintaining the herds in the inner part of the Chicago district, and that the ratio of heifers to cows will never again be as large as it was in 1916. It is quite probable, however, that the ratio will increase until it is somewhat greater than it was in 1922.

The effects of the heavy production of milk in 1921 and 1922 were made worse by the demoralized condition of the condensed milk market. In October, 1920, many condenseries closed and others made drastic cuts in the prices paid for milk. Naturally, some of the milk that had previously been condensed sought the Chicago market and the existing surplus was still further increased.

SEASONAL VARIATION IN PRODUCTION

In addition to the variation in production from year to year which results from the combination of numerous economic factors, there is the much greater seasonal variation. This variation is an ever present problem to the milk distributor and, because of the maladjustment of supply and demand, a highly important factor in determining the prices received by the producer.

The seasonal variation in the production of milk is shown by Table 9 and Fig. 5. The dairy district has been divided into sections in order to show some important differences between the various regions. For example, Cook and Lake counties show the least variation, with Kane and McHenry counties next. It is worthy of note that the production in these counties, which represent the most intensive district, is very little greater during the months of May and June than it is during January, February, March, and April. On the other hand, in the more distant parts of the Chicago dairy district the production during May and June is much higher than during the other months. This is particularly true of the Swiss-cheese region which is represented by Green and LaFayette counties. The winter production in this region is extremely low, the amount produced in December being but 44 percent of the June production.

The greater seasonal variation in production in the surplus-milk region is another factor which tends to retard the extension of the Chicago dairy district and gives the producers in the inner district an

TABLE 9.—SEASONAL VARIATION IN AMOUNT OF MILK PRODUCED IN DIFFERENT SECTIONS OF CHICAGO DAIRY DISTRICT[a]

Based on sales of milk from an average of 3,051 dairy farms during the three-year period 1920 to 1922. Average monthly sales for 36 months = 100 percent

Month	Average amount of milk sold daily per farm											
	Cook and Lake counties, Ill.		Kane and McHenry counties, Ill.		Will, DeKalb, Ogle, and Boone counties, Ill.		Kenosha, Waukesha, and Rock counties, Wis.		Green and Lafayette counties, Wis.		All	
	lbs.	*perct.*	*lbs.*	*perct.*	*lbs.*	*perct.*	*lbs.*	*perct.*	*lbs.*	*perct.*	*lbs.*	*perct.*
January	246	104.2	322	104.9	154	96.2	199	102.4	138	71.0	238	100.4
February	257	108.8	338	110.2	166	103.7	215	110.6	149	76.6	252	106.3
March	273	115.6	348	113.3	176	109.8	225	115.7	170	87.4	264	111.4
April	273	115.6	352	114.6	173	108.1	226	116.2	205	105.4	268	113.1
May	275	116.4	376	122.4	203	126.8	252	129.6	275	141.4	296	124.9
June	264	111.8	360	117.2	213	133.1	251	129.1	298	153.2	292	123.2
July	206	87.2	278	90.5	161	100.6	172	88.5	245	126.0	223	94.1
August	196	83.0	255	83.0	145	90.6	152	78.2	224	115.2	204	86.1
September	198	83.8	247	80.4	131	81.8	143	73.6	193	99.2	193	81.4
October	211	89.3	261	85.0	134	83.7	159	81.8	172	88.4	202	85.2
November	208	88.1	261	85.0	128	80.0	162	83.3	135	69.4	198	83.6
December	227	96.2	287	93.5	137	85.6	177	91.0	130	66.8	214	90.3
Average	236	100.0	307	100.0	160	100.0	194	100.0	194	100.0	237	100.0

[a]Corrected for secular trend.

advantage because of their greater seasonal uniformity. It must be remembered, however, that the newer regions can adjust their production to the changed conditions which a fluid-milk market imposes.

The most striking feature of the seasonal variation is the low production during the months of July, August, and September. At this

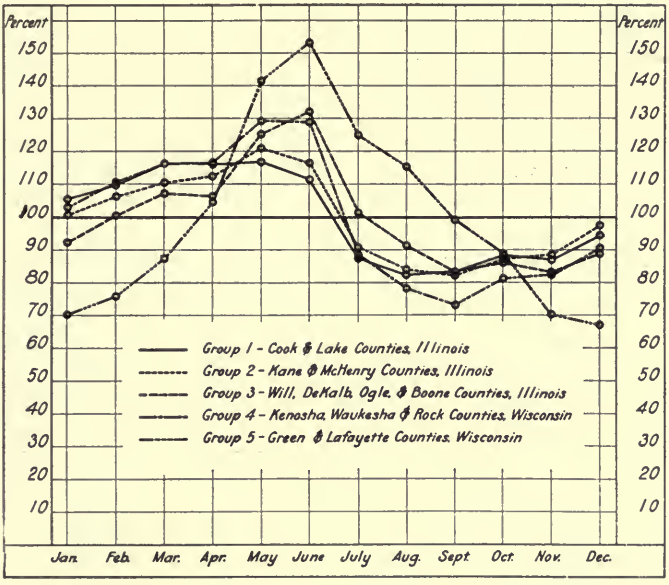

FIG. 5.—SEASONAL VARIATION IN PRODUCTION OF MILK IN DIFFERENT PARTS OF THE CHICAGO DAIRY DISTRICT

The graph represents the amounts of milk sold from an average of 3,051 farms during the three-year period 1920 to 1922. The average monthly sales for thirty-six months equal 100 percent. The least seasonal variation is found in the inner district (Groups 1 and 2). Altho the variation in the Swiss-cheese region (Group 5) is very marked, the proportion of milk produced during the shortage period in the late summer is greater than for any of the other districts. Some dealers draw on this territory to supplement their supply at that time.

time flies are bad, pastures are short, few dairymen have sufficient silage for summer feeding, and the fall- and winter-freshening cows are well advanced in the lactation period.

If a dealer's regular supply of milk from the country is sufficient for his needs during this period, it means that his surplus is very large during the season of heavy production. In order to avoid this surplus he may depend on jobbers or other dealers for a part of his supply during the summer, but the number of companies which can follow this practice is, of course, limited.

In addition to the preceding figures, which are based on detailed data taken from the books of three large companies, supplementary

figures showing the range in the seasonal production for 1922 were obtained by a survey of 64 dealers. During the season of low production (August and September) the combined daily purchases of these companies amounted to 1,476,978 pounds of milk. Their purchases during the season of heaviest production (May and June) totaled 2,128,086 pounds per day, or 44.1 percent more than the purchases during the shortage period.

Table 10 shows the differences between the purchases for May and June and for August and September for companies of various sizes. As would be expected, the smaller companies have in general the least variation in purchases, because they get practically all their supply from the inner district, where the seasonal production is most nearly uniform. Group 4, in which are classed dealers purchasing from 20,001 to 30,000

TABLE 10.—DIFFERENCE IN AMOUNTS OF MILK PRODUCED DURING SEASON OF HEAVY PRODUCTION AND SEASON OF LEAST PRODUCTION

Group	Volume handled daily per dealer, May and June	Number of dealers	Total daily purchases, May and June, 1922	Total daily purchases, Aug. and Sept., 1922	Ratio of May and June purchases to Aug. and Sept. purchases
	lbs.		*lbs.*	*lbs.*	*perct.*
1.....	Less than 5 000	23	53 312	43 942	121.3
2.....	5 001 to 10 000	10	79 650	66 114	120.5
3.....	10 001 to 20 000	12	207 641	149 829	138.6
4.....	20 001 to 30 000	5	115 580	94 060	122.9
5.....	30 001 to 40 000	8	279 325	194 872	143.3
6.....	Over 40 000	6	1 392 578	928 161	150.0
Total...		64	2 128 086	1 476 978	144.1

pounds of milk daily, shows, however, less variation in the seasonal purchases than does Group 3, which handles less milk. The more uniform supply of Group 4 is easily accounted for by the chance grouping of five dealers who receive from the inner district 93 percent of all the milk which they purchase. Group 3, on the other hand, includes twelve dealers, some of whom purchased milk in Wisconsin, where the seasonal production shows greater variation.

The six large dealers who purchase milk from all parts of the dairy district had the greatest seasonal variation. During the flush season (May and June) they received one and one-half times as much milk as during the shortage season (August and September).

In view of the large volume of milk handled by these 64 dealers it appears safe to conclude that in 1922 the May and June production in the Chicago dairy district as a whole was approximately 44 percent greater than the August and September production. This proportion varies, of course, for individual companies and in different years.

A few dealers who obtain the greater part of their supply from the

inner district have found it advantageous to establish one or more plants in the cheese districts, where spring-freshening cows predominate and where the bulk of the year's production comes during the pasture period. Altho this still further increases the May and June surplus, it supplements the short supply from the inner district during the summer months. Green and LaFayette counties, Wisconsin, (Fig. 5) are illustrations of counties which show a much higher production in July, August, and September than any of the other districts.

SEASONAL PRODUCTION AND PRICE

Since 1919, dealers and producers have attempted to obtain a more uniform production of milk thruout the year by changing the relative

TABLE 11.—SEASONAL VARIATION IN PRICE OF 3.5-PERCENT MILK AT COUNTRY STATIONS IN CHICAGO DISTRICT BY FIVE-YEAR PERIODS, 1904 TO 1923[a]

Average monthly price for each 60-month period = 100 percent

Month	1904 to 1908	1909 to 1913	1914 to 1918	1919 to 1923
	perct.	*perct.*	*perct.*	*perct.*
January	123.0	119.5	113.4	106.8
February	118.3	116.1	107.1	101.8
March	109.6	106.2	99.9	94.8
April	99.3	92.9	99.2	92.8
May	75.7	76.3	81.8	87.8
June	67.0	68.4	70.1	87.0
July	74.9	82.3	87.1	103.0
August	89.9	91.6	98.7	110.0
September	97.8	95.6	99.5	102.9
October	108.8	109.5	111.2	106.0
November	115.9	118.8	116.0	105.1
December	119.8	122.8	116.0	102.0
Average	100.0	100.0	100.0	100.0

[a]Corrected for secular trend.

levels of winter and summer prices. This is shown by Table 11, which shows the seasonal variation in milk prices by five-year periods from 1904 to 1923. Until 1919, the winter price of milk was very high as compared with the spring and summer prices, and winter dairying was stimulated. The result, as previously discussed, was too much winter milk and a sharp decline in production in the late summer. Beginning with 1919, milk prices for the months of May, June, July, August, and September have been relatively much higher than before, while the winter prices have been relatively lower.

This change in the relative prices for summer and winter has apparently had little effect on the seasonal production of milk in the inner part of the dairy district, as may be seen by Table 12. In spite of the greater seasonal uniformity in prices, which has been maintained since 1919, the high winter production continues. Tho this may be

TABLE 12.—SEASONAL VARIATION IN AMOUNT OF MILK PRODUCED IN INNER PART OF CHICAGO DAIRY DISTRICT BY FIVE-YEAR PERIODS, 1908 TO 1922[a]

Average monthly sales for each 60-month period = 100 percent

Month	Average daily sales of milk per farm					
	1908 to 1912		1913 to 1917		1918 to 1922	
	lbs.	*perct.*	*lbs.*	*perct.*	*lbs.*	*perct.*
January	395	110.0	390	110.1	391	107.6
February	403	112.2	406	114.6	407	112.0
March	401	111.7	395	111.5	419	115.3
April	395	110.0	391	110.4	403	110.9
May	412	114.8	404	114.1	415	114.2
June	419	116.7	417	117.7	405	111.5
July	324	90.2	327	92.3	310	85.3
August	269	74.9	283	79.8	281	77.3
September	292	81.3	277	78.2	287	79.2
October	305	84.9	290	81.9	316	86.9
November	326	90.8	316	89.2	343	94.4
December	368	102.5	355	100.2	383	105.4
Average	359	100.0	354	100.0	363	100.0

[a]Based on sales from an average of 544 farms to seven plants in Lake, Kane, and McHenry counties, Illinois.

TABLE 13.—SEASONAL DISTRIBUTION OF FRESHENING COWS AS INDICATED BY RECORDS FROM FIFTEEN COW-TESTING ASSOCIATIONS IN NORTHERN ILLINOIS[a]

Number of cows freshening each month expressed as percentages of total for year

Month	Group 1 Cook and Lake counties		Group 2 Kane, McHenry, and DuPage counties		Group 3 DeKalb, Ogle, Boone, and Winnebago counties		All	
	No.	*perct.*	*No.*	*perct.*	*No.*	*perct.*	*No.*	*perct.*
January	274	9.7	407	10.1	163	10.0	844	10.0
February	289	10.2	349	8.7	97	6.0	735	8.7
March	290	10.3	370	9.1	86	5.3	746	8.8
April	191	6.8	244	6.0	100	6.2	535	6.3
May	171	6.1	217	5.4	49	3.0	437	5.2
June	128	4.5	168	4.2	42	2.6	338	4.0
July	133	4.7	205	5.1	49	3.0	387	4.5
August	124	4.4	295	7.3	87	5.4	506	6.0
September	258	9.1	443	11.0	234	14.4	935	11.0
October	340	12.1	499	12.4	295	18.2	1134	13.4
November	329	11.7	438	10.9	228	14.1	995	11.7
December	294	10.4	394	9.8	192	11.8	880	10.4
Total	2821	100.0	4029	100.0	1622	100.0	8472	100.0

[a]Acknowledgment is due Mr. C. S. Rhode, Assistant Professor of Dairy Husbandry Extension, for his courtesy in permitting the use of these records.

partly due to the fact that changes in farm practice naturally lag behind changing price levels, the principal reason is the fact that summer prices are not yet high enough to induce farmers to produce summer milk in competition with crop growing in regions where a very large proportion of the land is tillable.

The preference for fall-freshening cows in this region is clearly shown by Table 13, which gives the months of freshening of 8,472 cows during the years 1917 to 1922. It is significant that the least number of spring-freshening cows is found in DeKalb, Ogle, Boone, and Winnebago counties, where dairying is of minor importance and crop growing of major importance.

It is an open question whether it is more economical to raise summer prices and lower winter prices until a more uniform seasonal production is obtained, or to draw upon the summer dairying regions of Wisconsin to supplement the short summer and fall supplies. Either course, however, is preferable to the present situation, which requires the carrying of a large surplus during the winter months, when production costs are highest. The present tendency, as has been indicated, is both to change the seasonal price levels and to draw on the summer dairies of Wisconsin.

CONSUMPTION OF DAIRY PRODUCTS IN CHICAGO

When the present study was undertaken, it was hoped that accurate information on the per capita consumption of milk in Chicago could be obtained. The difficulty of securing complete enough figures, however, made impossible anything but an estimate. Figures were obtained from retail routes showing the average daily sales of milk per family. The data included sales to 7,743 families in one section of Chicago and to 8,511 families in another part of the city. The first section embraces one of the better residential districts, where the people have incomes sufficient for the luxuries of life; some may be classed as wealthy, while many are prosperous business or professional men. In the second district the incomes are smaller, being derived largely from clerical and factory employment. Altho not one of the poorest sections of the city, this district ranks somewhat below the other.

During January, 1923, the average daily retail sales of milk amounted to 1.65 pints per family in the wealthier section of the city. *In the poorer district, the sales were almost 20 percent greater,* or 1.96 pints per family. The larger consumption per family in the poorer section may be due, on the one hand, to the fact that a family with a small income exercising the greatest care in its expenditure feels that it gets full value from the purchase of milk, and on the other hand, to the number of children per family.

By making proper allowances for the amount of milk and cream purchased at wholesale (Table 14), it is possible to compute the per capita consumption for the city as a whole if it is assumed that these 16,254 families are typical. Such an assumption, of course, is open to question, but under the circumstances it is the best approach to an estimate. Assuming further that these families were of average size (4.33 persons each)[1] and consumed the average amount of dairy

[1]United States Bureau of the Census.

products, the daily per capita consumption of milk would be only 0.62 pounds, and of milk and cream in terms of 3.5-percent milk, 1.01 pounds.

Altho the foregoing figures on the per capita consumption are somewhat unsatisfactory because of the relatively small proportion of the population which is included, a very large mass of data was obtained which gives accurate information on the aggregate demands of this market. The following data cover the entire city and because of the large amount of business represented may be taken as correctly portraying the demand for dairy products in Chicago.

TABLE 14.—RELATIVE CONSUMPTION OF CERTAIN DAIRY PRODUCTS IN CHICAGO

Estimate based on the combined sales of seventy-two milk dealers[a] operating approximately 60 percent of the retail wagons in Chicago

Product	Unit	Total sales per day				
		Retail	Wholesale	Total	Equivalent of 3.5-percent milk	
					lbs.	*perct.*
Milk	Quarts	363 445	71 899	435 344	935 990	47.2
Milk	Pints	95 602	29 957	125 559	134 976	6.8
Milk	Half-pts.	.....	26 425	26 425	14 203	.7
Certified milk	Quarts	4 182	.....	4 182	8 991	.5
Bulk milk	Gallons	.....	14 093	14 093	121 200	6.1
Cream						
22-percent	Half-pts.	96 782	23 439	120 221	400 456	20.2
32-percent	Half-pts.	9 616	.....	9 616	45 859	2.3
22-percent, bulk	Gallons	.....	5 098	5 098	271 723	13.7
32-percent, bulk	Gallons	.....	671	671	51 197	2.5
Total	.....	.....	.....	.....	1 984 595	100.0

[a]Including 17 strictly retail dealers, 5 wholesale dealers, and 50 dealers doing both retail and wholesale business.

The relative amounts of milk and cream consumed in Chicago are indicated by Table 14. A limited number of products are included in the table, but these comprize by far the greatest part of the milk consumption. It may be noted that fluid milk makes up 61.3 percent of the total consumption and that 77.5 percent of this amount is purchased in quart bottles. On the basis of the retail and wholesale sales of these 72 dealers, it may be concluded that about 29 pints of milk and 28 half-pints of "coffee" cream are purchased for each 100 quarts of milk.

CONSUMPTION IN DIFFERENT SECTIONS OF CHICAGO

The foregoing estimates apply to the consumption of milk in the city as a whole. As may be seen from Table 15, these proportions vary in different parts of Chicago and in the suburbs.

For purposes of comparison, the city was divided into sections based on the territory served by different distributing stations. The

relative consumption of dairy products in a few representative sections is shown. Altho the population of the various districts is not exactly homogeneous from sociological and economic standpoints, the preponderance of certain classes is sufficiently great so that the sections may be taken as typical of the various standards of living. Thus, Section A represents a district of comfortable homes and moderately large incomes, and includes some districts made up largely of the Semitic race. Section B is a region of high rentals and high property values, and includes many apartment hotels. Section C includes a somewhat mixed native and foreign population, while Section D includes the Negro district, a part of the foreign district and a small corner of

TABLE 15.—RELATIVE CONSUMPTION OF CERTAIN DAIRY PRODUCTS IN DIFFERENT PARTS OF CHICAGO

Based on average retail sales to more than 200,000 families during the three-year period 1920 to 1922

Section of Chicago[a]	Amount consumed for each 100 quarts of milk			
	Pints of milk	Half-pints of 22-percent cream	Half-pints of 32-percent cream	Quarts of buttermilk
A	16.5	18.3	1.8	1.6
B	24.3	41.5	2.8	2.7
C	23.5	18.9	1.4	2.8
D	39.2	39.4	3.0	8.7
E	23.7	26.0	1.9	2.1
Oak Park	18.9	20.7	1.8	2.1
Evanston	15.9	39.7	3.4	3.6
All of Chicago and suburbs	28.9	28.2	2.4	3.7

[a]See key map, Fig. 6, for selected sections of the city, and Table F, Appendix, for monthly consumption data.

the better-class white section. The great south-side residential district is represented by Section E. Oak Park and Evanston are shown as representative of the suburbs.

The consumption of dairy products in these districts shows some interesting relations. For instance, it has ordinarily been supposed that a pint of milk was the usual purchase of poor families. The high proportion of pints sold in Section D (39.2 pints for each 100 quarts) would appear to substantiate this belief. As a matter of fact, however, the heavy sale of pints is due largely to the great factory district included in this section. During the summer, many factory workers drink milk with their lunches and the proportion of pints is thereby greatly increased. During the winter, many of the workers change to coffee or other hot drinks and the sale of pints falls off markedly.

With the exception of the district just mentioned, Section B purchases a greater proportion of pints than any other district shown, altho it has practically no factories and comprizes a region of high property

values and high rentals. Far more wealth is represented here than in Section A, but the ratio of pints to quarts is 50 percent greater than in the less affluent district. In all probability, the higher consumption of milk in Section A is partly due to the large number of Semitic people who are noted as being heavy consumers of milk.

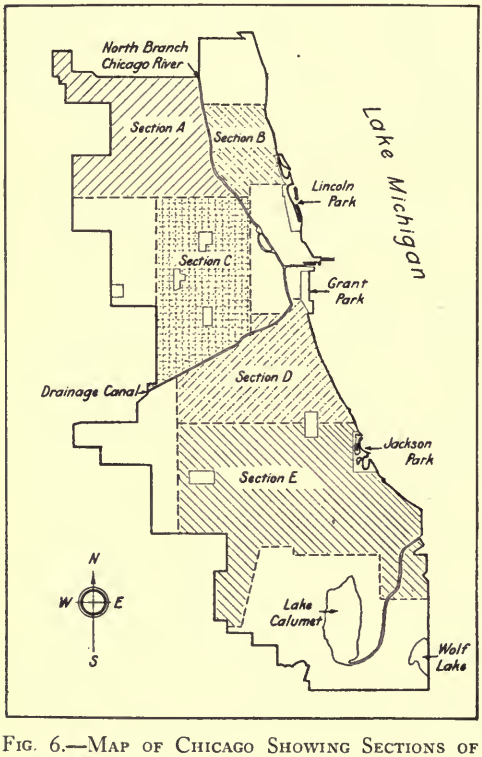

FIG. 6.—MAP OF CHICAGO SHOWING SECTIONS OF CITY SELECTED FOR STUDYING CONSUMPTION OF DAIRY PRODUCTS

The demand for dairy products is different in the various sections of the city because of economic and racial differences in the population.

Several milk dealers have voiced the opinion that milk in pint bottles is too expensive for the poor and that the quart is their usual purchase. The data in Table 15 and the figures on the consumption per family (page 489) would tend to confirm the view, but a more detailed study than is here possible should be made before extending the above generalization to include the more needy families.

The sales of cream, in comparison with the sales of quarts of milk, vary greatly in the different districts. It is not surprising that Section A, which was classed as a region of comfortable homes but of no great wealth, consumes only 18.3 bottles of 22-percent cream for each 100 quarts of milk, while the wealthier and more fashionable Section B consumes more than twice as much (41.5 bottles). Similarly Oak Park, which has a somewhat smaller proportion of wealthy residents than Evanston, purchases only 20.7 half-pints of cream for each 100 quarts of milk, as compared with 39.7 for Evanston. Section C, which includes one of the poorer sections of Chicago, also shows relatively small purchases of cream (18.9 bottles). On the other hand, Section D, which includes the poorest district in the city and is made up of a large Negro and foreign population, purchases 39.4 half-pints of cream for each 100 quarts of milk, or practically as much as Section B and

Evanston. In addition to the Negro and foreign districts, Section D includes one corner of a moderately prosperous white district, but since this district occupies less than one-tenth of the total area of Section D, it appears improbable that the purchases in such a relatively small area could be sufficiently great to raise the level of the whole district to the height indicated. It seems evident, therefore, that the Negro population has a taste for cream in spite of the apparent lack of wealth in the region.

Similar variations in the sale of 32-percent cream were found, altho the price of "whipping" cream[1] keeps the sale of this commodity at

TABLE 16.—RELATIVE CONSUMPTION OF MILK AND CREAM IN CHICAGO AND SUBURBS
Amount consumed per 100 quarts of milk

	Computed from:	Pints of milk	Half-pints of 22-per-cent cream	Half-pints of 32-per-cent cream
Retail sales of 2 large dealers; 3-year average, 1920–1922	Table 15	28.9	28.2	2.4
Retail and wholesale sales of 72 dealers; March, 1922	Table 14	28.8	27.6	2.2
Difference		.1	.6	.2

about one-tenth that of "coffee" cream (22-percent fat). The three leading sections of the city in the consumption of the higher testing cream are, again, the fashionable and prosperous Section B and Evanston and the Negro and foreign Section D.

Both Evanston and Section D show a decided liking for pure-culture ripened skim milk, known by the trade as buttermilk. In the suburb, the proportion is 3.6 quarts of buttermilk for each 100 quarts of milk. The Negro and foreign populations of Section D, however, are by far the largest consumers of buttermilk, purchasing 8.7 quarts for each 100 quarts of milk.

The foregoing statements, relating to the consumption of milk in various sections of Chicago, are based on the average daily retail sales of two large companies over a period of three years (1920 to 1922). It is evident from Table 16 that the consumption represented by these sales is representative of the consumption of the city as a whole; that is, the relative amounts of milk and cream sold at retail by the two large dealers are practically the same as the relative amounts sold at wholesale and retail combined by the 72 dealers included in Table 14. The following data on consumption are also based on the three-year average sales of the two large companies.

[1]Table B, Appendix.

LONG-TIME TREND OF CONSUMPTION

Several very significant changes in the secular, or long-time, trend of consumption are indicated by the wholesale and retail sales of milk and cream during the years covered by these data. The annual increase or decrease in sales of each product is expressed in Table 17 in percentages of the three-year average. Since these data are based on the total sales of certain dealers, the increase during the period under study may have been due to one or more of the following factors: (1) increased per capita consumption; (2) increased population; or (3) increased business for these particular dealers at the cost of customers for other dealers. Hence, figures of the secular trend in sales are signi-

TABLE 17.—TREND[a] IN SALE OF CERTAIN DAIRY PRODUCTS FOR THE THREE-YEAR PERIOD 1920 TO 1922

Yearly increase expressed in percentages of average sales for the period

Product	Unit of sale	Annual increase in sales	
		Retail	Wholesale
		perct.	*perct.*
Milk	Gallons	....	1.1
Milk	Quarts	6.4	1.0
Milk	Pints	20.1	12.3
Milk	Half-pints	....	68.7
Certified milk	Quarts	(–.9)	....
Buttermilk	Quarts	(–.8)	....
Cream			
18-percent	Gallons	....	4.3
20-, 22-, 24-, 26-, 30- and 32-percent	Gallons	....	19.5
22-percent	Half-pints	7.3	3.0
32-percent	Half-pints	3.7	14.3
All milk	Bottled and bulk	7.8[c]	
All cream	Bottled and bulk	8.4[c]	
All milk and cream[b]	Bottled and bulk	8.0[c]	

[a]Lines of secular trend fitted by method of least squares.
[b]In terms of 3.5-percent milk.
[c]Retail and wholesale.

ficant only in showing relative changes. For instance, during these three years (1920 to 1922), the annual increase in the sales of all milk by these dealers was 7.8 percent of the average of the period, but which of the three factors causing this increase was the most important can only be surmised. By comparing the percentage increases of the various products, however, very significant changes in consumption are apparent.

Retail sales are based on the purchases of over 200,000 families and *differences* in the rate of increase are undoubtedly indicative of the trends of consumption. Wholesale sales, however, are based on purchases of a relatively small number of buyers, some of whom take only one grade of cream or, perhaps, only bulk milk. The transfer of their trade from one dealer to another under the existing competitive condi-

tions necessarily affects these figures in a way not possible in the case of the retail sales. This is particularly true in the case of bulk milk and cream, and very much less so for bottled goods because of the larger number of purchasers of milk in this form.

The increase in the sale of pints of milk at retail has been three times as rapid as the increase in the sale of quarts. At the same time the sale of certified milk actually decreased. Buttermilk also failed to hold its own. Retail sales of "coffee" cream increased twice as rapidly as the sales of "whipping" cream. Of special interest is the rapid growth of the school trade in half-pints of milk. From practically nothing at the beginning of 1920, this business grew to large proportions by the end of 1922. The sale of pints of milk at wholesale also grew rapidly, the rate of increase being twelve times that of quarts or of bulk milk.

SEASONAL VARIATION IN CONSUMPTION

The consumption of dairy products by individuals varies considerably in different seasons, and this, together with the migration from the city during the summer vacation months, results in significant

TABLE 18.—SEASONAL VARIATION IN CONSUMPTION OF MILK AND CREAM IN CHICAGO AND SUBURBS[a]

Based on daily retail[b] and wholesale sales of milk and cream equivalent to 865,000 pounds of 3.5-percent milk. Average monthly sales for 36 months (1920 to 1922) = 100 percent.

Month	Bottled and bulk milk	Bottled and bulk cream in terms of 3.5-percent milk	Total milk and cream in terms of 3.5-percent milk
	perct.	*perct.*	*perct.*
January	98.2	100.6	99.0
February	100.2	104.6	101.8
March	101.3	105.3	102.7
April	100.1	106.6	102.4
May	99.8	104.3	101.4
June	102.1	99.0	101.0
July	98.4	90.5	95.6
August	96.3	88.0	93.4
September	101.2	93.5	98.4
October	103.2	99.0	101.8
November	101.1	102.6	101.6
December	98.1	106.0	100.9
Average	100.0	100.0	100.0

[a]Corrected for secular trend.

[b]Of the total sales included in the table, the proportionate amounts sold at retail were as follows: milk, 73 percent; cream, 56 percent; milk and cream combined, 67 percent.

seasonal variations in the total consumption of milk in the city. Table 18 shows the extent of this variation.

From January until June there is a somewhat irregular increase in the amount of milk consumed. With the close of school, the exodus of

people from the city begins. Sales fall off rapidly, and the low point is reached in August.

The public schools open immediately following Labor Day, and a large proportion of the vacationists return at that time. The others follow shortly, and practically all are back in the city by October, when the peak of consumption is reached. During this month, 7 percent more milk is consumed than during the low month, August.

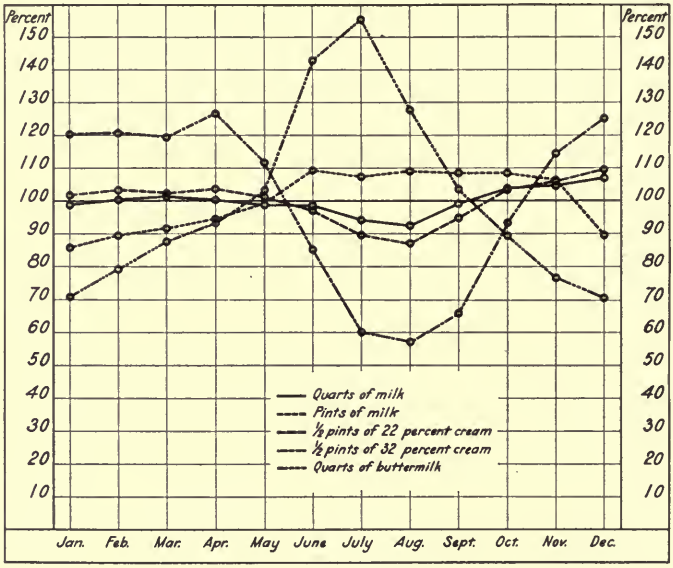

FIG. 7.—SEASONAL VARIATION IN CONSUMPTION OF CERTAIN DAIRY PRODUCTS IN CHICAGO AND SUBURBS

Sales of cream and quarts of milk decrease in the summer, when people leave the city for their vacations. Sales of buttermilk and pints of milk increase, because hot weather stimulates their use as beverages. This graph is based on retail sales to more than 200,000 families during the three-year period 1920 to 1922. (Secular trend not removed. Average monthly sales for thirty-six months equal 100 percent.)

The advent of cold weather again cuts the sales, which decline for the next two or three months.

The seasonal variation in the consumption of cream is still greater. August is the low month, while the heaviest consumption comes during the winter and early spring. A fifth more cream is consumed in April than in August.

The combined consumption of milk and cream expressed in terms of whole milk shows peaks in the spring and fall, with a slight decrease in mid-winter and a decided falling off during the summer.

A more detailed analysis of the seasonal variation in consumption is shown by Table 19 and Fig. 7, which give the fluctuations in the retail sales of certain dairy products. During the months of May, June,

July, August, and September, the sale of quarts of milk is below the average of the year. The sale of pints, on the other hand, is greatest during these months. Greater use of milk as a luncheon drink by workers and lack of ice in many households explain the summer demand for pints, while the decrease in the sale of quarts is accounted for by vacations and week-end trips.

The effect of this temporarily decreased population is better illustrated by the retail sale of cream. As may be seen from Table 19, the consumption of "coffee" cream (22 percent fat) falls off markedly during July and August, the sales during the latter month amounting to only 81 percent of the December peak. The consumption of "whipping" cream shows a much greater decrease, the sales in August amounting to only 44 percent of the April peak. It may naturally be

TABLE 19.—SEASONAL VARIATION IN RETAIL SALES OF CERTAIN DAIRY PRODUCTS[a]
Average monthly sales for 36 months (1920 to 1922) = 100 percent

Month	Quarts milk	Pints milk	Half-pints 22-percent cream	Half-pints 32-percent cream	Quarts buttermilk	Quarts certified milk
	perct.	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
January	103.4	87.6	105.4	121.9	70.9	98.7
February	103.7	89.7	105.9	121.9	79.2	102.0
March	103.1	98.2	104.4	120.5	87.7	103.6
April	101.4	99.3	105.1	127.6	93.2	100.6
May	99.5	102.5	102.1	112.4	103.1	101.3
June	98.8	110.8	97.3	85.3	142.9	99.8
July	93.7	107.3	89.4	59.9	155.3	93.7
August	91.6	107.3	86.1	56.6	127.7	95.1
September	97.5	105.2	93.5	65.1	103.5	100.1
October	101.9	103.5	101.3	92.1	89.4	102.4
November	102.2	99.4	103.3	113.1	76.7	101.7
December	103.2	89.2	106.2	123.6	70.4	101.0
Average	100.0	100.0	100.0	100.0	100.0	100.0

[a]Corrected for secular trend and changes in the relative prices of pints and quarts.

concluded that a larger number of the people who buy the more expensive "whipping" cream are financially able to spend at least a portion of the summer away from Chicago.

Buttermilk is a popular summer drink, over twice as much of this product being consumed in July and August as is consumed in December and January.

Wholesale sales (Table 20) show a seasonal variation which differs from that of retail sales. The demand for bulk milk, quarts, and pints, is highest during the summer. Sales of half-pints of milk correspond very closely to the school year, altho a certain amount of office trade gives some outlet for milk in this form during the summer vacation. The effect of the Christmas holiday on the half-pint trade is easily discernible in the December demand. The wholesale sales of cream show about the same seasonal variation as do the retail sales, altho

they are somewhat more irregular, owing probably to the greater effect of competition.

In the foregoing discussion of the seasonal consumption of dairy products, the aggregate demand of the city rather than individual demand was considered. Altho the total sales of milk decline in the summer, in all probability the purchases of people remaining in the city are higher per person during this period than at any other time, but the data used here are not in a form to prove or disprove this belief. However, it is the total demand of a city or of a district, and not the per capita demand, that is of greatest interest to both producers and dealers.

TABLE 20.—SEASONAL VARIATION IN WHOLESALE SALES OF CERTAIN DAIRY PRODUCTS[a]
Average monthly wholesale sales for 36 months (1920 to 1922) = 100 percent

Month	Gallons bulk milk	Quarts milk	Pints milk	Half-pints milk	Gallons 18-perct. cream	Half-pints 22-perct. cream	Half-pints 32-perct. cream
	perct.	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
January.....	91.3	94.2	84.7	119.2	93.4	96.6	108.3
February...	98.6	95.4	84.7	120.8	103.5	99.0	113.3
March.....	101.8	95.7	85.4	136.3	106.7	98.8	116.6
April.....	99.7	94.3	89.0	120.3	105.8	103.7	128.4
May.....	98.8	96.9	97.7	115.9	98.6	107.7	147.4
June.....	103.6	106.5	117.2	90.9	92.2	102.8	109.4
July.....	103.8	110.7	120.6	28.6	85.4	99.3	76.7
August.....	102.8	107.4	121.4	26.0	94.4	100.3	70.5
September..	101.1	109.7	120.8	88.6	95.2	103.0	73.6
October.....	103.0	102.4	108.6	136.6	105.4	99.6	77.7
November...	100.0	94.6	92.6	132.7	108.0	94.1	85.9
December...	95.5	92.2	77.3	84.1	111.4	95.1	92.2
Average..	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Corrected for secular trend.

VARIATION IN CONSUMPTION BY DAYS OF THE WEEK

Not only does the consumption of dairy products vary with the season, but, as may be seen by Table 21 and Fig. 8, it also varies with the days of the week. In so far as the sale of quarts of milk is concerned, Sunday and Monday are the only days that show significant variations from the normal. On Sunday, many housewives purchase an extra quart of milk, while others for whom a pint a day is the usual purchase, buy a quart. The result is an increase of approximately 5 percent in the sales. Apparently, however, there is a slight tendency to overstock, because on Monday the sale of quarts is about 3 percent below normal.[1]

As would be expected, pints of milk are purchased in the smallest numbers on Sunday, altho Saturday also shows a low consumption.

[1]The average consumption for the five days, Tuesday, Wednesday, Thursday, Friday, and Saturday, has been arbitrarily designated as normal because the Sunday and Monday purchases show the greatest variation for most dairy products.

The chief reason, of course, is the fact that with the Sunday holiday and the Saturday half-holiday, fewer people are lunching away from home and the demand for milk as a luncheon drink is greatly decreased. The fact that they are at home accounts to some extent for the increased sale of quarts on Sunday.

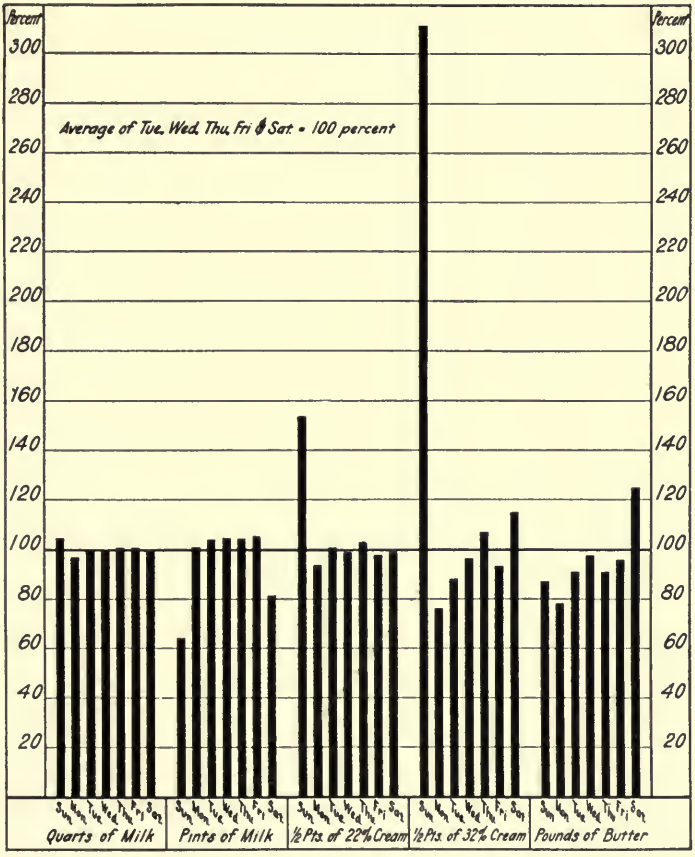

FIG. 8.—VARIATION IN CONSUMPTION OF CERTAIN DAIRY PRODUCTS IN CHICAGO AND SUBURBS BY DAYS OF THE WEEK

Saturday and Sunday are poor days for the sale of pints of milk, but the sale of quarts on Sunday is a little above the average. Sunday is the big day for cream, especially for whipping, but the housewives tend to overstock and on Monday the sales fall below normal.

The greatest variation in the consumption of dairy products is to be found in the case of cream. The Sunday sale of "coffee" cream is 54 percent above normal, while the sale of "whipping" cream on that day is three times as great as during the rest of the week. In both

cases, the tendency to overstock is shown by the subnormal consumption of Monday.

The consumption of cream on Thursday, as shown in Table 21 and Fig. 8, is slightly exaggerated because of the large amounts that are purchased for Thanksgiving Day. Sales of "coffee" cream on that day

TABLE 21.—CONSUMPTION OF CERTAIN DAIRY PRODUCTS IN CHICAGO AND SUBURBS BY DAYS OF THE WEEK

Based on average retail sales to more than 200,000 families during the three-year period 1920 to 1922. Average sales for the five days Tuesday, Wednesday, Thursday, Friday, and Saturday = 100 percent.

Day of week	Quarts milk	Pints milk	Half-pints 22-percent cream	Half-pints 32-percent cream	Pounds butter
	perct.	*perct.*	*perct.*	*perct.*	*perct.*
Sunday	104.7	64.3	153.7	311.9	87.0
Monday	97.2	100.8	93.7	76.4	78.1
Tuesday	99.9	104.2	100.7	88.1	91.1
Wednesday	99.3	104.9	99.3	96.3	97.6
Thursday	100.4	104.4	103.1	107.3	90.8
Friday	100.4	105.2	97.6	93.0	95.6
Saturday	100.0	81.3	99.3	115.3	124.9

are almost double the regular Thursday sales, while six times the usual amount of "whipping" cream is required to supply the demand. As three of the 157 Thursdays which are included in the three-year period, 1920 to 1922, were marked by the heavy Thanksgiving Day sales, the average for Thursday is raised a small amount. Even if the three days of abnormal purchases are omitted, however, the Thursday consumption is still a little above normal. Other holidays affect sales of milk and cream also.

CONSUMPTION OF MILK AS AFFECTED BY TEMPERATURE

The consumption of milk in Chicago not only increases as summer approaches, but it also fluctuates from day to day with fluctuations in temperature. The location of the city on Lake Michigan makes the temperature during the summer months subject to abrupt changes: when the wind blows from the lake, it is usually cool; a shift to the west or south ordinarily brings warmer weather and an increased demand for milk.

The degree of correlation between the daily fluctuations of temperature and the corresponding fluctuations in the sale of milk is shown by Table 22. The correlation for retail milk is higher than for wholesale milk. This is to be expected, because for retail milk the relation is between temperature and purchases by actual consumers, while for the wholesale milk the relation is between temperature and estimates by hotel and restaurant managers of the amount that will be consumed.

The extent to which temperature affects the retail sales of quarts and pints of milk and the wholesale sales of bulk milk is different in each case, as shown by Table 23. Quarts of milk are least affected, since purchases are largely for household use. The proportion of pints purchased by workers to drink with their lunches is greater than for

TABLE 22.—CORRELATION COEFFICIENTS OF TEMPERATURE AND SALES OF MILK FOR THE SUMMER PERIOD, MAY TO OCTOBER[a]

Product	[b]Correlation coefficient	Probable error
Quarts, retail.....	+0.523	±.038
Pints, retail.....	+0.567	±.035
Bulk, wholesale...	+0.331	±.046

[a]Based on the daily consumption of over 400,000 people during the summer of 1922.

[b]Correlation of the number of degrees that the maximum temperature on a given day varies from the average of the maximum temperatures of the previous seven days, and the percentage that the sales of milk on the following day deviate from the average sales of the previous seven days. Sales of milk corrected for secular trend and for seasonal and day-of-the-week variations.

From a purely statistical standpoint, a more desirable correlation is that of percentage deviations of temperature from the normal and percentage deviations of sales from the expected sales, both expressed in terms of standard deviations. On this basis, the correlation coefficient of temperature and sales of quarts of milk is +0.547 ± .026, as compared with +0.523 ±.038 obtained by the above method. Altho a slightly higher degree of correlation is thus obtained, the method of computing the deviations is much more involved. Furthermore, calculations of "normal" temperatures and "expected" sales require data on the temperature and sales for a period following the day on which the deviations are to be measured. This, of course, precludes the use of such deviations in predicting sales, since a milk dealer has only past temperatures and past sales on which to base his prediction. For this reason, the method involving deviations from previous weeks' averages has been used.

quarts, and the sale of pints is therefore more affected by temperature. A large share of the bulk milk is sold to restaurants and hotels, and as a result temperature changes have a very marked effect on the sales. Altho some of this bulk milk was probably used for ice cream, the amount is relatively small, as no sales by jobbers or by dealers doing a strictly wholesale business were included.

The most striking feature of the effect of temperature on sales is shown when a sudden drop of fifteen or twenty degrees occurs. The resulting decrease in consumption is very much greater than the increase which follows a sudden rise of an equal number of degrees. It appears that many people who drink milk at lunch find a hot drink more to their liking when there is a sharp fall in temperature. Since milk is very rarely used as a hot drink, they shift to coffee, tea, or cocoa, and the demand for milk is thereby decreased. On the other hand, there are many iced drinks from which to choose if the coffee- and tea-drinkers prefer a cold drink when the temperature climbs suddenly. Since milk gets only a part of this shift in demand, the increase in sales is much

less than it would be if there were no alternative cold drinks from which to choose.[1]

These variations in demand may be anticipated to some extent. Since most of the milk is delivered very early in the morning during the summer, a hot or cold day affects the next day's demand rather than the sales for that day. Hence, the amount of milk that is bottled may be varied according to the temperature.

TABLE 23.—EFFECT OF TEMPERATURE CHANGES ON SALES OF BOTTLED AND BULK MILK DURING THE SUMMER PERIOD, MAY TO OCTOBER

Deviation of maximum temperature on a given day from average of maximum temperatures of previous seven days	Predicted sales for the following day in percentage of average sales of previous seven days[a]					
	When temperature increases			When temperature decreases		
	Quarts retail	Pints retail	Bulk wholesale	Quarts retail	Pints retail	Bulk wholesale
Degrees						
1	100.1	100.1	100.4	99.9	99.9	99.6
2	100.1	100.2	100.7	99.9	99.8	99.2
3	100.2	100.3	101.0	99.8	99.7	98.8
4	100.2	100.4	101.3	99.8	99.6	98.4
5	100.3	100.5	101.6	99.7	99.4	98.0
6	100.4	100.6	101.9	99.6	99.2	97.6
7	100.4	100.7	102.2	99.5	99.0	97.2
8	100.5	100.8	102.5	99.5	98.8	96.8
9	100.5	100.8	102.8	99.4	98.6	96.4
10	100.6	100.9	103.1	99.3	98.4	96.0
11	100.6	101.0	103.3	99.2	98.2	95.5
12	100.7	101.1	103.5	99.2	98.0	95.0
13	100.8	101.2	103.7	99.1	97.8	94.5
14	100.8	101.3	103.9	99.0	97.6	94.0
15	100.9	101.3	104.1	98.9	97.4	93.5
16	101.0	101.4	104.3	98.8	97.1	93.0
17	101.1	101.5	104.5	98.7	96.8	92.5
18	101.1	101.6	104.6	98.6	96.5	92.0
19	101.2	101.6	104.7	98.5	96.2	91.5
20	101.3	101.7	104.8	98.4	95.9	91.0

[a]From curves fitted to means of arrays by the curvilinear approximation method. Ezekiel, Mordecai: A method of handling curvilinear correlation for any number of variables. Jour. Amer. Statis. Assoc., 19, n. s. 148, December, 1924.

By the use of these data, sales for the ensuing day may be predicted with a considerable degree of certainty. For example, let it be assumed that a dealer has sold an average of 30,000 quarts, 10,000 pints, and 1,000 gallons of bulk milk during the last week in May. The average temperature was 70 degrees, but on Tuesday the temperature

[1]This suggests a somewhat neglected point toward which advertising to increase milk consumption could be directed. For many years soft drink manufacturers have stressed the refreshing effect of their beverages when consumed on a hot day. It might pay to do the same with milk.

falls to 55, a decrease of 15 degrees. From Table 23 it may be seen that the demand for quarts the next day will be 98.9 percent of the previous week's average; the demand for pints, 97.4 percent; and the demand for bulk milk, only 93.5 percent: or 29,670 quarts, 9,740 pints, and 935 gallons of bulk milk. These, however, are averages for the week, and to get the sales for any particular day it is necessary to multiply these figures by the corresponding percentage variations for the day of the week (Table 24). Hence, for the estimation for Wednesday's delivery 29,670 quarts would be multiplied by 99.5 percent; 9,740 pints, by 111.9 percent; and 935 gallons of bulk, by 106.6 percent. The results, 29,522 quarts, 10,899 pints, and 997 gallons, would be the amounts the dealer could expect to sell.

TABLE 24.—DAY-OF-THE-WEEK CORRECTIONS FOR PREDICTING SALES OF MILK FROM TEMPERATURE CHANGES DURING SUMMER PERIOD

Expressed in percentage of average sales of previous seven days

Day of week	Quarts retail		Pints retail, May to October	Bulk wholesale, May to October
	School period[a]	Vacation period[b]		
Sunday	103.2	101.6	59.7	80.3
Monday	97.8	98.3	109.7	98.7
Tuesday	99.6	100.3	111.4	99.4
Wednesday	99.5	99.6	111.9	106.6
Thursday	100.4	100.5	112.3	107.0
Friday	100.0	100.3	113.0	101.6
Saturday	99.5	99.4	82.0	106.4
Average	100.0	100.0	100.0	100.0

[a]From May 1 to close of public schools and from Labor Day to October 31.
[b]From close of public schools to Labor Day.

Since the correlation is not perfect, it is impossible to predict exactly the demand for milk from temperature alone, but the above tables may be used as a guide, if a reasonable margin of safety is allowed. Various factors, such as rapidly growing business, vacation migrations, holidays, and sections of the city where the day-of-the-week variations differ, would introduce errors into these computations which would need to be allowed for by the dealer using them.

CONSUMPTION OF MILK AS AFFECTED BY PRICE

The foregoing discussion of the consumption of dairy products is based on average figures for the three-year period 1920 to 1922. During that time, however, there were six changes in the retail price of quarts of milk and five changes in the price of pints. Quarts ranged from 12 to 16 cents, and pints from 7 to 10 cents. This naturally had some effect on the amount of milk sold. The extent to which these changes affected the sale of milk was determined as indicated on page 510.

TABLE 25.—AMOUNTS THAT SALES OF QUARTS OF MILK DEVIATE FROM EXPECTED SALES[a] FOR THREE WEEKS BEFORE AND THREE WEEKS AFTER CHANGES IN RETAIL PRICES OF QUARTS OR PINTS

Date of price change	Retail price of quarts	Retail price of pints	Ratio of price of pints to price of quarts	Percentage actual sales were of expected sales							
				Preceding price change			Following price change			Average of 3 weeks preceding change	Average of 3 weeks following change
				3d week	2d week	1st week	1st week	2d week	3d week		
1920	*cts.*	*cts.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
Previous to March 1....	15	9	60.0								
March 1.....	14	9	64.3	100.4	100.2	99.8	101.4	101.3	101.3	100.1	101.3
July 1.....	15	9	60.0	100.8	99.8	101.2	98.5	99.3	99.3	100.6	99.0
August 5.....	16	10	62.5	99.3	99.5	101.2	100.5	99.9	99.5	100.0	100.0
November 1.....	15	9	60.0	100.7	100.6	99.3	100.1	100.2	100.0	100.2	100.1
December 1.....	14	9	64.3	99.9	99.8	98.9	100.8	99.8	99.8	99.5	100.1
1921											
February 1.....	14	8	57.1	99.5	99.6	99.9	100.0	99.8	100.0	99.7	99.9
September 1.....	12	7	58.3	101.0	98.5	98.9	100.7	102.1	100.8	99.5	101.2
1922											
December 1.....	12	8	66.7	99.1	99.1	99.2	99.2	101.1	101.1	99.1	100.5

[a]Corrected for secular trend and seasonal variation.

TABLE 26.—AMOUNTS THAT SALES OF PINTS OF MILK DEVIATE FROM EXPECTED SALES[a] FOR THREE WEEKS BEFORE AND THREE WEEKS AFTER CHANGES IN RETAIL PRICE OF QUARTS OR PINTS

Date of price change	Retail price of quarts	Retail price of pints	Ratio of price of pints to price of quarts	Percentage actual sales were of expected sales							
				Preceding price change			Following price change			Average of 3 weeks preceding change	Average of 3 week following change
				3d week	2d week	1st week	1st week	2d week	3d week		
1920	*cts.*	*cts.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
Previous to March 1....	15	9	60.0								
March 1.....	14	9	64.3	100.2	100.6	100.6	91.0	87.9	87.6	100 5	88.8
July 1.....	15	9	60.0	103.2	99.1	101.8	98.8	99.7	100.0	101.4	99.5
August 5.....	16	10	62.5	100.0	100.0	100.0	92.5	89.6	88.3	100.0	90.1
November 1.....	15	9	60.0	99.9	101.9	100.7	99.5	100.9	102.2	100.8	100.9
December 1.....	14	9	64.3	100.5	103.0	100.3	102.1	100.1	99.9	101.3	100.7
1921											
February 1.....	14	8	57.1	101.9	100.6	99.0	99.5	99.2	99.6	100 5	99.4
September 1.....	12	7	58.3	99.2	98.5	102.2	102.1	102.7	102.3	100.0	102.4
1922											
December 1.....	12	8	66.7	99.6	100.5	100.1	81.9	74.6	72.1	100.1	76.2

[a]Corrected for secular trend and seasonal variation.

TABLE 27.—AMOUNTS THAT SALES OF QUARTS AND PINTS OF MILK COMBINED DEVIATE FROM EXPECTED SALES[a] FOR THREE WEEKS BEFORE AND THREE WEEKS AFTER CHANGES IN THE RETAIL PRICE OF EITHER

Date of price change	Retail price of quarts	Retail price of pints	Ratio of price of pints to price of quarts	Percentage actual sales were of expected sales							
				Preceding price change			Following price change			Average of 3 weeks preceding change	Average of 3 weeks following change
				3d week	2d week	1st week	1st week	2d week	3d week		
1920	*cts.*	*cts.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
Previous to March 1...	15	9	60.0								
March 1.....	14	9	64.3	100.4	100.2	99.9	100.2	99.7	99.7	100.2	99.9
July 1.....	15	9	60.0	101.1	99.7	101.3	98.5	99.3	99.4	100.7	99.1
August 5.....	16	10	62.5	99.4	99.5	101.1	99.4	98.5	98.0	100.0	98.6
November 1.....	15	9	60.0	100.7	100.7	99.5	100.0	100.3	100.2	100.3	100.2
December 1.....	14	9	64.3	100.0	100.2	99.0	101.0	99.8	99.8	99.7	100.2
1921											
February 1.....	14	8	57.1	99.7	99.7	99.8	99.9	99.8	100.0	99.7	99.9
September 1.....	12	7	58.3	100.7	98.5	99.4	100.9	102.1	101.0	99.5	101.3
1922											
December 1.....	12	8	66.7	99.2	99.3	99.4	96.7	97.4	97.1	99.3	97.1

[a]Corrected for secular trend and seasonal variation.

TABLE 28.—CHANGES IN SALES OF QUARTS OF MILK DUE TO CHANGES IN RETAIL PRICES OF QUARTS OR PINTS

Date of price change	Retail price of quarts	Retail price of pints	Ratio of price of pints to price of quarts	[a]Percentage change from average sales of three weeks preceding price change			
				1st week following price change	2d week following price change	3d week following price change	Average of 3 weeks following price change
1920	*cts.*	*cts.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
Previous to March 1	15	9	60.0				
March 1	14	9	64.3	+1.3	+1.2	+1.2	+1.2
July 1	15	9	60.0	−2.1	−1.3	−1.3	−1.6
August 5	16	10	62.5	+ .5	− .1	− .5	0
November 1	15	9	60.0	− .1	0	− .2	− .1
December 1	14	9	64.3	+1.3	+ .3	+ .3	+ .6
1921							
February 1	14	8	57.1	+ .3	+ .1	+ .3	+ .2
September 1	12	7	58.3	+1.2	+2.6	+1.3	+1.7
1922							
December 1	12	8	66.7	+ .1	+2.0	+2.0	+1.4

[a]Expressed in percentages of the expected sales.

TABLE 29.—CHANGES IN SALES OF PINTS OF MILK DUE TO CHANGES IN RETAIL PRICE OF QUARTS OR PINTS

Date of price change	Retail price of quarts	Retail price of pints	Ratio of price of pints to price of quarts	[a]Percentage change from average sales of three weeks preceding price change			
				1st week following price change	2d week following price change	3d week following price change	Average of 3 weeks following price change
1920	*cts.*	*cts.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
Previous to March 1	15	9	60.0				
March 1	14	9	64.3	−9.5	−12.6	−12.9	−11.7
July 1	15	9	60.0	−2.6	−1.7	−1.4	−1.9
August 5	16	10	62.5	−7.5	−10.4	−11.7	−9.9
November 1	15	9	60.0	−1.3	+ .1	+1.4	+ .1
December 1	14	9	64.3	+ .8	−1.2	−1.4	− .6
1921							
February 1	14	8	57.1	−1.0	−1.3	− .9	−1.1
September 1	12	7	58.3	+2.1	+2.7	+2.3	+2.4
1922							
December 1	12	8	66.7	−18.2	−25.5	−28.0	−23.9

[a]Expressed in percentages of the expected sales.

TABLE 30.—CHANGES IN SALES OF QUARTS AND PINTS OF MILK COMBINED DUE TO CHANGES IN RETAIL PRICE OF EITHER

Date of price change	Retail price of quarts	Retail price of pints	Ratio of price of pints to price of quarts	[a]Percentage change from average sales of three weeks preceding price change			
				1st week following price change	2d week following price change	3d week following price change	Average of 3 weeks following price change
1920	*cts.*	*cts.*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*
Previous to March 1	15	9	60.0				
March 1	14	9	64.3	0	− .5	− .5	− .3
July 1	15	9	60.0	−2.2	−1.4	−1.3	−1.6
August 5	16	10	62.5	− .6	−1.5	−2.0	−1.4
November 1	15	9	60.0	− .3	0	− .1	− .1
December 1	14	9	64.3	+1.3	+ .1	+ .1	+ .5
1921							
February 1	14	8	57.1	+ .2	+ .1	+ .3	+ .2
September 1	12	7	58.3	+1.4	+2.6	+1.5	+1.8
1922							
December 1	12	8	66.7	−2.6	−1.9	−2.2	−2.2

[a]Expressed in percentages of the expected sales.

Data on the weekly retail sales of milk were corrected for secular trend and seasonal variation and the expected sales were computed on the basis of these corrected data. The actual sales of milk for three weeks before and for three weeks after each change in the retail price were expressed as percentages of the "expected" sales. Tables 25 to 30 show the deviation of the actual from the "expected" sales and the changes in consumption that may be attributed to changes in the retail price.

These data indicate that:

1. An increase in price tends to cut consumption slightly, while a decrease in price stimulates demand to an even slighter degree.

2. Sales of quarts of milk seem to be less influenced by price changes than sales of pints.

3. A change in the price of one unit without a corresponding change in the price of the other causes a shift in the proportionate sales of the two units.

4. The net change in consumption, when both pints and quarts of milk are combined, is surprisingly small considering the percentage change in price which a change of one cent occasions.

The shifting from quarts to pints or vice versa, due to changes in the relative price of the two units, is emphasized by Fig. 9, which shows the ratio of pints to quarts. The chart indicates, also, the danger of confusing seasonal variation with changes in demand due to price changes.

It should perhaps be noted that the period under consideration was one of violent price fluctuations for nearly all commodities, and the consumption of milk may have been less affected by price changes than it would have been in more stable times. For this period, however, these data indicate that on the average a change of one cent a quart changed the consumption of milk less than one percent, or occasioned about the same change as results from a variation in temperature of 10 degrees from one summer day to the next.

THE PROBLEM OF SURPLUS MILK

The two divisions of this study immediately preceding, dealt with the production and consumption of milk. The present division deals with the natural resultant of these two factors when production is greater than consumption; that is, with surplus milk.

The term "surplus milk" may have two meanings. One dealer may apply it to all milk purchased above the bottled and bulk milk requirements of his trade. Another may reserve it for milk purchased in excess of the amount necessary to supply his trade with all the usual products, including cream and butter. The first definition is probably the more common and as a matter of convenience will be adopted here. Altho it might appear somewhat more logical to exclude from surplus milk that which is used to supply the regular cream trade, to do so

would complicate an analysis of the surplus problem, because many dealers buy a part or all of their cream from the country or from jobbers at prices which are normally lower than the cost of cream separated from milk, for which they have paid the regular fluid-milk price.

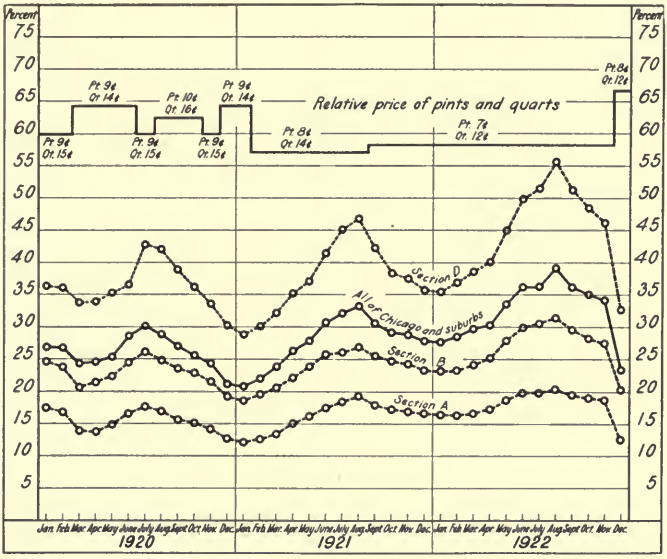

FIG. 9.—CHANGES IN PROPORTIONATE PURCHASES OF PINTS AND QUARTS OF MILK DUE TO CHANGES IN RELATIVE PRICES OF THE TWO UNITS

The small circles show the ratio of pints to quarts in different parts of the city. The upper line shows the relative price of pints and quarts. When the price of pints is high as compared with the price of quarts, some consumers change their purchases from the smaller to the larger unit. Note the relative decrease in pints in March, 1920, and in December, 1922.

VARIATION IN SURPLUS FROM YEAR TO YEAR

In comparing the price paid by the consumer and the price received by the producer, we are likely to think of all the milk purchased as being sold at the retail price of bottled milk. Table 31 shows that this is far from true. Data were obtained from one company covering a period of seven years and it may be seen that even during the wartime shortage of milk the total annual surplus amounted to 28 percent of all the milk purchased. During 1921 and 1922 the surplus handled by this company amounted to approximately 35 percent of the purchases. During the same years Company B had a surplus of about 30 percent. In other words, only about two-thirds of the milk purchased was sold as bottled or bulk milk. The rest was separated for cream or made up into other dairy products.

It is a significant fact that the amount of surplus milk was high during 1921 and 1922, when the spread between the retail price per quart of *bottled milk* and the wholesale price per quart for *all milk purchased* was greatest (Fig. 1). That is, the greater the proportion of milk going into lower priced products, the lower must be the flat price paid for all milk purchased.

Altho this study does not deal with the cost of distributing milk, brief mention may well be made of that problem in order to avoid the

TABLE 31.—YEARLY VARIATION IN AMOUNT OF SURPLUS MILK HANDLED BY TWO COMPANIES

Total amount of milk purchased each year = 100 percent

Year	Company A		Company B	
	Bottled and bulk milk	Surplus milk	Bottled and bulk milk	Surplus milk
	perct.	*perct.*	*perct.*	*perct.*
1916	61.1	38.9	[a]	[a]
1917	68.3	31.7	[a]	[a]
1918	73.9	26.1	[a]	[a]
1919	66.9	33.1	[a]	[a]
1920	71.6	28.4	78.9	21.1
1921	65.3	34.7	70.2	29.8
1922	65.5	34.5	70.5	29.5

[a]Data not available.

inference that the wide spread between the retail price of milk and the wholesale price to the producer during 1921 and 1922 was due entirely to the great amount of surplus handled during those years. The cost of producing milk has declined since 1920 much more rapidly than transportation, plant, and distribution costs. Low feed prices during 1921 and 1922 greatly decreased production costs. On the other hand, most of the costs of handling the milk have decreased only a little or not at all. Transportation rates have been lowered slightly; coal and supplies, particularly horse feed, have tended downward; but labor, one of the chief items of cost in distributing milk, is still at the peak. An example of this is the amount the retail drivers receive for delivering a bottle of milk.[1] The milk drivers' union has obtained for the drivers a guaranteed minimum wage of $45 for a week of six days and in addition a commission of six-tenths of a cent for each point[2] sold above 1,333 points a week.

[1]December, 1924.

[2]A half-pint of milk counts as one-half point. With this exception, each bottle of milk, cream, or buttermilk counts at least as much as a point regardless of whether it is a quart, pint, or half-pint. A few products count as more than one point. Butter is usually handled on a cash commission basis of one cent a pound.

The sales per driver vary widely, but an estimate, based on the records of 58 retail dealers included in Table 14, makes the average for the city as a whole about 250 points. On this basis the average amount received by the drivers would be approximately 3.1 cents for each bottle of milk, cream, or buttermilk delivered.[1] This does not include the salaries of route inspectors nor allow for the annual vacation of the drivers.

Thus the high plant and distribution costs have prevented the dealers handling margin from decreasing to any extent. With the cost of producing milk much lower than it was during 1918, 1919, and 1920, the inevitable result has been a change in the proportionate amount of the consumer's dollar which goes to the producer. As was stated before, the share remaining in the dealers' hands was still further increased by the large amount of surplus during 1921 and 1922, which could be used only for cream and for the manufacture of lower priced products.

RELATION BETWEEN SIZE OF BUSINESS AND AMOUNT OF SURPLUS

The amount of surplus milk handled in 1922 was very high for all but the smaller dealers. Table 32 shows the relation between the size of business and the relative amount of surplus milk handled during the season of heaviest production and the season of shortage. Since the figures are based on the amount of surplus milk at two particular seasons of the year, they are not comparable with the total annual surplus of Company A or Company B (Table 31).

The smaller dealers handled relatively less surplus than the larger dealers during both the season of heavy production and the season of light production. Thus, for the three groups of dealers handling less than 20,000 pounds of milk daily, the May and June surplus ranged from 21 to 30 percent of the total amount of milk purchased, while the August and September surplus ranged from about 3 percent to 10 percent. The surplus of these small dealers is kept at a minimum during the season of light production because they depend largely on jobbers for their cream supply and frequently make up any shortage of milk by purchase from jobbers or from the larger dealers. The May and June surplus is also relatively small, due to the fact that most of the small dealers draw their milk supply from the inner district, where the seasonal production is more nearly uniform (Table 9).

The larger dealers, on the other hand, must go farther for a part of their supply, drawing on the regions where the seasonal variation in production is much greater. This results in a very large May and June surplus, ranging from 39 to 48 percent of the total purchases for the three larger groups of dealers. Even the August and September surplus is

[1] $\$45.00 + \frac{\$45.00}{6} + \$.006\ [(7)\ (250) - 1333]$

$$\frac{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}{7(250)} = \$.031$$

TABLE 32.—RELATION BETWEEN SIZE OF BUSINESS AND AMOUNT OF SURPLUS MILK HANDLED DURING SEASON OF HEAVY PRODUCTION AND SEASON OF LEAST PRODUCTION

Group	Volume of milk handled daily per dealer, May and June	Number of Dealers	Total daily purchases of milk		Bottled and bulk milk sold	Percentage surplus milk was of total purchases	
			May and June	August and September		May and June	August and September
	lbs.		*lbs.*	*lbs.*	*lbs.*	*perct.*	*perct.*
1	Less than 5 000	23	53 312	43 942	39 688	25.6	9.7
2	5 001 to 10 000	10	79 650	66 114	62 967	21.0	4.8
3	10 001 to 20 000	12	207 641	149 829	144 807	30.3	3.4
4	20 001 to 30 000	5	115 580	94 060	70 251	39.2	25.3
5	30 001 to 40 000	8	279 325	194 872	162 005	42.0	16.9
6	Over 40 000	5	1 345 009	891 171	695 707	48.3	21.9
	Total[a]	63	2 080 517	1 439 988	1 175 425	43.5	18.4

[a]One company included in Table 10 has been omitted here because records of sales were not available.

relatively large because, unlike the small dealers, they cannot depend wholly on jobbers and other dealers in case of an emergency. It is one thing for a small dealer to buy a few hundred pounds of milk to fill a sudden shortage of 5 or 10 percent and another thing for a large dealer to find several thousand pounds to supply a similar shortage. This does not mean that the larger dealers do not buy milk from jobbers or from each other when the need arises, but the amounts available from such sources are, of course, limited.

SEASONAL VARIATION IN AMOUNT OF SURPLUS

Since the production of milk shows a wide seasonal variation and the consumption of milk shows somewhat less variation, it is to be

TABLE 33.—SEASONAL VARIATION IN AVERAGE AMOUNT OF SURPLUS MILK HANDLED BY TWO COMPANIES DURING THE THREE-YEAR PERIOD 1920 TO 1922

Month	COMPANY A		COMPANY B	
	Percentage surplus was of total milk purchased	Percentage variation when average surplus for 36 months = 100 percent[a]	Percentage surplus was of total milk purchased	Percentage variation when average surplus for 36 months = 100 percent[a]
January	33.7	104.4	17.4	64.6
February	36.9	122.2	20.0	74.5
March	38.7	132.6	25.9	100.7
April	39.9	137.5	32.0	131.4
May	45.3	170.6	42.7	198.4
June	43.5	162.9	42.5	195.3
July	30.9	87.2	33.3	123.0
August	25.9	64.4	30.6	105.3
September	18.1	40.7	23.5	77.2
October	20.4	48.2	18.8	58.9
November	20.4	49.9	12.8	32.7
December	28.9	79.4	14.1	37.5
Total	32.8	100.0	27.3	100.0

[a]Corrected for secular trend.

expected that the amount of surplus will also vary at different seasons of the year. Naturally this variation will depend on the year and also on the region from which any individual dealer may obtain his supply.

Table 33 shows the average seasonal variation in the amount of surplus milk handled by two large companies. Company A had over four times as much surplus in May and June as it did in September. Company B, on the other hand, had about six times as much surplus in May and June as it did in November. The latter company obtained a considerable part of its supply from the Swiss-cheese region of Wisconsin, where spring-freshening cows predominate. Altho this still further increased the May and June surplus, it tended to maintain the supply during the late summer, when production in the inner dis-

trict was lowest (page 485). As a result, this company had the least amount of surplus during November and December.

Data on the amount of surplus milk were obtained from Company A, by months, for a period of seven years. During four of the seven years the heaviest surplus came in June, while for the other three years May showed the greatest surplus. September was the month of least surplus for four years, while August, October, and November each had the least surplus one year.

During the three years covered by the data obtained from Company B, May twice showed the greatest surplus and June once. November, December, and January each showed the least surplus during one year.

From the above it may be seen that individual companies may have seasonal variations in the amount of surplus milk which do not coincide with the seasonal variations for the city as a whole. In general, however, dealers expect the least amount of surplus in the late summer and early autumn. The surplus increases gradually until the cows are turned on pasture early in May. For two months, May and June, the surplus is extremely large. In July, a combination of factors such as hot weather, flies, short pastures, and advanced lactation for the fall-freshening cows, brings a sudden drop in production which is only partly offset by the decreased demand (Table 18). The result is a decline in the amount of surplus milk, which is much more abrupt than any of the other seasonal changes. The further decline to the low point of the year is more gradual.

Daily Variation in Amount of Surplus

The reason that a certain amount of surplus milk must be carried at all times by the dealers becomes apparent from a study of the day-to-day variations. It was shown (Table 21 and Fig. 8) that the consumption of milk varies with the days of the week. Thus, on Sunday the demand for quarts of milk is about 5 percent above normal, while for pints it is far below normal; the demand for pints on Saturday is little better. The school trade in half-pints is entirely lacking on both Saturday and Sunday, and the sale of bulk milk also falls. The result is a decided increase in the amount of surplus milk on these days. For Company A (Table 34), the average daily surplus in 1922 amounted approximately to 37 percent of the total milk purchased for Saturday and 40 percent for Sunday, as compared with an average of approximately 34 percent for the other days. In other words, even had it been possible for this company to have eliminated all surplus on the other days of the week, it would have still been compelled to handle surplus milk amounting approximately to 4.5 percent of its purchases for Saturday and 6.9 percent for Sunday. A compensating feature of this Saturday and Sunday surplus, however, lies in the fact that it comes at a

very opportune time, as the milk can be separated to meet the heavy Sunday demand for cream (Table 21 and Fig. 8).

These week-end fluctuations in the amount of surplus milk are shown clearly by Fig. 10. In addition, this chart shows that there are

TABLE 34.—VARIATION, BY DAYS OF WEEK, IN AMOUNT OF SURPLUS MILK HANDLED BY COMPANY A IN 1922

Average daily surplus expressed in percentage of total amount of milk purchased

Day of sale[a]	Percentage surplus was of total purchased[b]	Range in amount of surplus above Friday minimum
Sunday	39.8	6.9
Monday	35.4	2.5
Tuesday	33.9	1.0
Wednesday	33.9	1.0
Thursday	33.5	.6
Friday	32.9	.0
Saturday	37.4	4.5

[a]As milk is bottled the day previous to its sale, the surplus comes upon the day preceding the sale.
[b]Simple averages.

sudden violent drops in the amount of surplus milk. Thus, the amount of surplus on Sunday, June 4, 1922, amounted to 123.8 percent of the bottled and bulk milk sales. On Sunday, June 11, the surplus was only 97.9 percent, *a decrease in one week amounting to over one-fourth of the bottled and bulk milk sales.* Similar abrupt declines in the amount of surplus milk occurred in July, August, and September. On several occasions, a single day's decrease in surplus, other than the regular daily variation, amounted to as much as 10 percent of the fluid-milk sales.

These declines are due to increases in the demand for milk or decreases in the supply. Frequently both factors operate at the same time. Thus the drop in the amount of surplus milk which occurred in the early part of June, 1922, was due both to the increased demand and to the decreased production resulting from the unseasonable heat, the temperature at Chicago reaching a maximum of 90 degrees on June 9. The late June decline, on the other hand, was due largely to decreased production. At this time pastures were very short owing to dry weather, only 0.65 inch of rain having fallen in northern Illinois during June.

The abnormal decreases occurring in July, August, September, and October, 1922, were due largely to hot weather which decreased the production and at the same time stimulated consumption. The big drop in the early part of September resulted from the combined factors of extremely hot weather (maximum temperature 98 degrees, September 2) and the return of most of the summer vacationists for the opening of school.

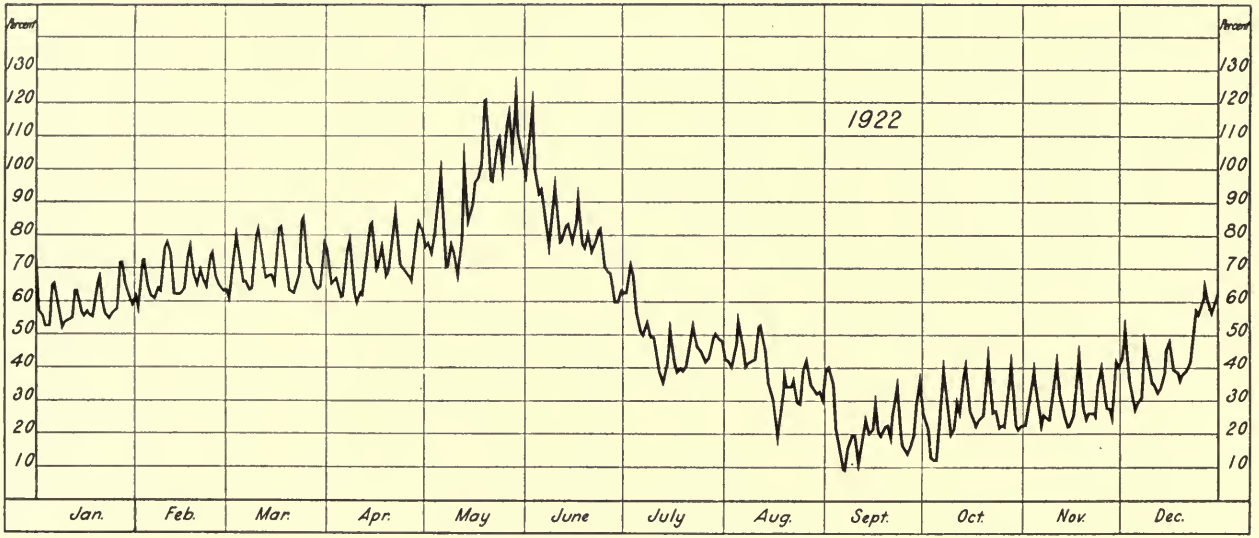

FIG. 10.—DAILY VARIATION IN AMOUNT OF SURPLUS MILK HANDLED BY COMPANY A

The amount of surplus is expressed in percentages of the amount sold as bottled and bulk milk. Because of the lessened demand for milk on Saturday and Sunday, the surplus on these two days is much higher than for the rest of the week. Hot weather or other factors may cause sudden decreases in the surplus by affecting both demand and supply. These contingencies necessitate the carrying of a certain amount of surplus as a margin of safety.

It is evident from the foregoing that a certain amount of surplus must be carried in order to guard against shortage arising from these sudden changes in supply and demand. Individual dealers, particularly the smaller ones, may shift the burden to jobbers, or other dealers, by depending on purchases from these sources to make up any shortage. In order to maintain a margin of safety, however, for the city as a whole, it appears that a surplus of something like 20 percent of the bottled and bulk-milk requirements should be carried during the summer. Had the margin been less than this during 1922, shortages would have occurred on a number of occasions. It should be noted, however, that during 1922 the surplus handled by Company A fell as low as 20 percent only for a very short period in the late summer. During six months of the year the surplus ranged from 50 percent to 125 percent of the bottled and bulk-milk sales. The least surplus on any one day occurred on September 11 and amounted to 9 percent of the next day's sales. Even had the total year's supply been sufficiently reduced so that on this day there was no surplus, the surplus for the rest of the year would still have amounted to 41.1 percent of the bottled and bulk-milk sales, thru the maladjustment of production and consumption.

THE UTILIZATION OF SURPLUS MILK

It may be seen from Table 14 that the amount of milk which must be separated to supply Chicago's daily demand for cream is approximately 60 percent as great as the amount that is sold as bottled and bulk milk. Naturally, any surplus milk which a dealer has after filling the demand for bottled and bulk milk will be separated. If this surplus does not give sufficient cream to supply his trade, he can make up the deficit by contracting for daily shipments of cream from one of the more remote parts of the dairy district, or by purchases from jobbers or other dealers. If the surplus is more than sufficient to supply his cream needs, it must be utilized in a still less profitable way. Butter is the product that is most generally made. Whether the cream is sold as such or made into butter, there remains the skim milk which can be utilized in various ways.

Table 35 shows the methods of utilizing surplus milk as reported by the dealers included in Table 32. Condensed and evaporated milk is ordinarily made from whole milk, while milk powder is almost always made from skim milk. American cheese may be made from whole milk during one or two months of the spring. Some dealers whose plant equipment does not include condensing pans sell their surplus to evaporated milk companies located in the immediate territory.

Detailed figures on the utilization of whole milk were obtained from two companies. Tables 36 and 37 show the relative amounts of milk which were sold as bulk and bottled milk or used for other dairy products. During the season of heavy production, a large amount of butter is made from separated cream, but data on the amount used for

TABLE 35.—METHODS OF UTILIZING SURPLUS MILK

Group	Volume of milk handled daily per dealer, May and June	Number of dealers	Dealers utilizing surplus milk in various ways during 1923					
			Butter	Cottage cheese	Evaporated or condensed	American cheese	Milk powder	Not reporting
	lbs.							
1	Less than 5 000	23	16	17	..	..	..	4
2	5 001 to 10 000	10	6	6	1	..	..	([a])
3	10 001 to 20 000	12	9	9	1	1	1	1
4	20 001 to 30 000	5	1	1	..	..	..	3
5	30 001 to 40 000	8	6	7	..	..	..	0
6	Over 40 000	5	4	4	1	1	1	1
All		63	42	44	3	2	2	9

[a]One dealer returns all skim milk to the farmers.

this purpose are not available. Neither was it possible to compute the amount of shrinkage for Company B, but as the loss is relatively small no deduction has been made from the amount shown as having been separated for cream.

TABLE 36.—UTILIZATION OF ALL MILK PURCHASED BY COMPANY A DURING THE SEVEN-YEAR PERIOD 1916 TO 1922

Disposal	Percentage of total purchases						
	1916	1917	1918	1919	1920	1921	1922
Bottled milk	56.2	63.0	68.0	60.2	63.4	58.3	58.5
Bulk milk	4.9	5.3	5.9	6.7	8.2	7.0	7.0
Sold to manufacturers	3.1	8.0	4.0	1 7	.4	2.5	.3
Evaporated milk	..	..	..	1.3	.5	3.5	2.8
Condensed milk	..	..	..	9.0	..	..	..
Cheese	..	..	..	.7	..	..	.2
Separated for cream	34.4	23.0	21.2	19.6	26.8	28.0	30.7
Shrinkage	1.4	.7	.9	.8	.7	.7	.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The relative amounts of milk utilized for various purposes are shown for each month by Figs. 11 and 12. These charts show also the great variation in the seasonal production of milk and the large proportion of surplus milk which was handled during 1921 and 1922.

The large amount of skim milk resulting from separating the surplus handled by Company A was utilized as indicated by Table 38 and

TABLE 37.—UTILIZATION OF ALL MILK PURCHASED BY COMPANY B DURING THE THREE-YEAR PERIOD 1920 TO 1922

Disposal	Percentage of total purchases		
	1920	1921	1922
Bottled milk	75.9	68.0	68.8
Bulk milk	3.0	2.2	1.7
Separated for cream[a]	21.1	29.8	29.5
Total	100.0	100.0	100.0

[a]Also includes shrinkage.

Fig. 13. A limited amount of skim milk was taken by bakeries and other industries, but this outlet was of minor importance. "Buttermilk" (pure culture ripened skim milk) offered a method of disposing of a certain amount, as did also cottage cheese. By far the greatest proportion, however, had to be utilized in other ways. The manufacture of milk powder was one of the principal methods of utilizing skim milk, but because of the low price of this product during 1921 and 1922 Company A arranged for the sale of most of the skim milk to farmers for feeding purposes. At certain times curd was sold to casein factories,

and for the first four months of 1920 a small amount of evaporated skim milk was made.

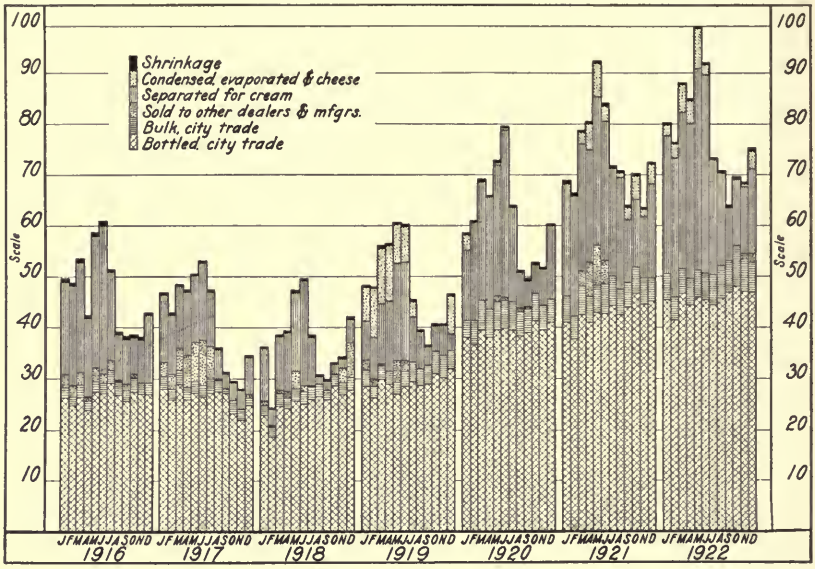

FIG. 11.—UTILIZATION OF MILK PURCHASED BY COMPANY A DURING THE SEVEN-YEAR PERIOD 1916 TO 1922

Note the large proportion of surplus milk during 1921 and 1922 and the wide variation in the amount of surplus in the different months. During some months less than half of the milk purchased is sold in fluid form. The rest is separated for cream or manufactured. Drawn to scale, with the month of highest purchase (May, 1922) equal to 100.

Some plants are not equipped to utilize skim milk to the best advantage, so that occasionally during the flush season of production large quantities are dumped in the sewers. This dumping is more commonly practiced by companies having no country plants where the

TABLE 38.—UTILIZATION OF SKIM MILK OBTAINED BY SEPARATING SURPLUS MILK OF COMPANY A DURING THE SEVEN-YEAR PERIOD 1916 TO 1922

Disposal	Percentage of total amount of skim milk						
	1916	1917	1918	1919	1920	1921	1922
Sold in Chicago	33.3	34.8	32.2	21.3	8.8	6.0	4.7
Buttermilk	9.2	10.7	10.5	13.5	11.7	10.1	8.5
Sold to farmers	13.9	2.6	1.3	.4	5.1	54.7	54.2
Milk powder	16.5	30.0	41.2	52.4	49.0	15.9	24.8
Cheese	13.7	14.8	6.3	6.0	16.4	9.5	7.8
Casein	13.4	7.1	8.5	6.4	3.6	3.8	..
Evaporated milk	..	..	..	..	5.4	..	..
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

whole milk can be separated and the skim milk returned to the farmer. This waste is usually decried by newspapers and is sometimes characterized as an attempt to destroy a part of the supply for the purpose of maintaining high prices. Waste it undoubtedly is, but with no profitable method of utilizing all the skim milk no other course is open. The low value of skim milk as compared with the high cost of bottling and distribution makes its sale on retail routes uneconomical.

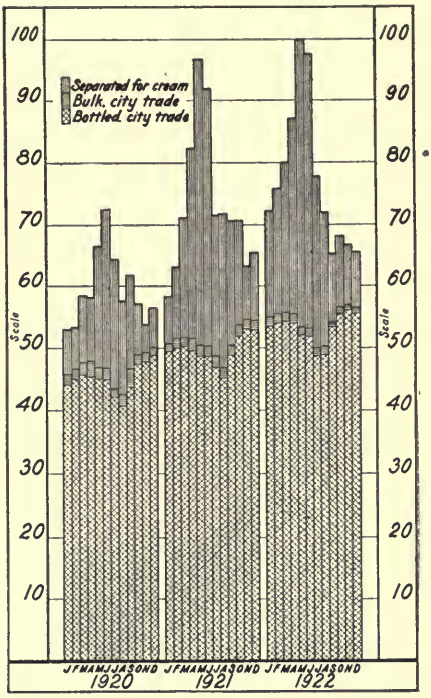

FIG. 12.—UTILIZATION OF MILK PURCHASED BY COMPANY B DURING THE THREE-YEAR PERIOD 1920 TO 1922

The surplus during 1921 and 1922 was large for this company also, but the winter surplus was relatively less than in the case of Company A, which did not get so large a proportion of milk from the Swiss-cheese region. Drawn to scale, with the month of highest purchase (May, 1922) equal to 100.

RELATION BETWEEN PRICES OF SWEET CREAM AND WHOLE MILK

It was stated previously (page 511) that many small and some large dealers purchase a part or all of their cream from jobbers or directly from the country. The advantage of this procedure under normal conditions is indicated by Table 39 and Fig. 14, which show the price per gallon for 36-percent sweet cream delivered by jobbers to city plants and the cost of an equivalent amount of 3.5-percent milk purchased at country plants. In the case of the whole-milk equivalent, no allowance has been made for the cost of separating and transporting the cream, or for the value of the skim milk. The comparison is directly between the price of a gallon of 36-percent cream at the city plant and the price of 85.4 pounds of 3.5-percent milk (its equivalent) in the country. Obviously this does not give an exact comparison of the cost of cream obtained in the two different ways, but it does show the change in the relative costs that took place during the summer of 1921.

During 1918, 1919, and 1920, the average cost of a gallon of 36-percent cream purchased as whole milk was 37 cents greater than the

TABLE 39.—COMPARISON OF PRICE OF 36-PERCENT CREAM DELIVERED BY A JOBBER TO DISTRIBUTOR'S CITY PLANTS AND COST OF AN EQUIVALENT AMOUNT OF CREAM PURCHASED AS WHOLE MILK AT COUNTRY PLANTS

85.4 pounds of 3.5-percent milk = 1 gallon of 36-percent cream

Month	1918		1919		1920		1921		1922		Five-year average	
	Jobber's price	Cost of milk	Jobber's price	Cost of milk	Jobber's price	Cost of milk	Jobber's price	Cost of milk	Jobber's price	Cost of milk	Jobber's price	Cost of milk
January	$2.25	$2.75	$2.37	$3.21	$2.40	$3.07	$1.62	$2.14	$1.44	$1.54	$2.02	$2.54
February	2.25	2.62	2.10	2.99	2.25	2.86	1.62	2.01	1.44	1.45	1.93	2.39
March	2.25	2.48	2.05	2.56	2.15	2.48	1.66	2.01	1.50	1.45	1.92	2.20
April	1.71	2.26	2.10	2.39	2.25	2.35	2.07	2.01	1.53	1.45	1.93	2.09
May	1.71	1.75	2.15	2.14	2.35	2.31	1.80	1.75	1.53	1.45	1.91	1.88
June	1.71	1.54	2.20	2.14	2.36	2.35	1.75	1.75	1.53	1.37	1.91	1.83
July	1.90	1.96	2.52	2.56	2.60	2.73	1.80	1.96	1.80	1.71	2.12	2.18
August	2.34	2.35	2.52	3.01	2.60	3.16	1.75	1.96	1.80	1.75	2.20	2.45
September	2.38	2.49	2.55	3.03	2.60	3.16	1.62	1.28	1.80	1.71	2.19	2.33
October	2.45	2.84	2.60	3.10	2.30	3.16	1.62	1.49	1.80	1.75	2.15	2.47
November	2.45	3.14	2.55	3.07	1.95	2.60	1.62	1.54	1.89	1.75	2.09	2.42
December	2.45	3.22	2.55	3.12	2.01	2.22	1.62	1.54	2.16	1.79	2.16	2.38
Average	$2.15	$2.45	$2.35	$2.78	$2.32	$2.70	$1.71	$1.79	$1.68	$1.60	$2.04	$2.26

jobbing price. For approximately half the 36 months included in this period, the difference was more than 50 cents a gallon. At such times, the surplus milk separated for cream made a relatively expensive source of supply, but with the prevailing system of buying milk, which required the dealers to take all the milk produced by their regular

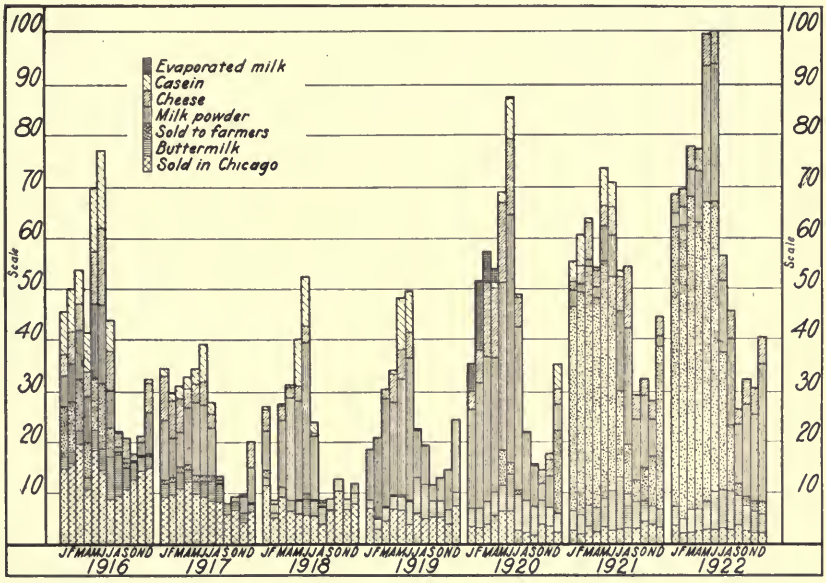

FIG. 13.—UTILIZATION OF SKIM MILK OBTAINED BY SEPARATING THE SURPLUS MILK NOTED IN FIG. 11

Part of the skim milk classed under the different products was manufactured by Company A and part was manufactured by other companies to which it was sold. During 1921 and 1922 a very large part of the skim milk was sold to farmers for feeding purposes because the price of milk powder was too low for profitable manufacture. Drawn to scale, with the largest amount of skim milk during one month (June, 1922) equal to 100.

patrons, no advantage could be taken of the lower jobbing prices. During the months of heaviest production, however, the price of cream purchased as whole milk was as low, or lower, than the price of cream obtained from the jobbers and little could have been gained by buying cream from them.

From September, 1921, to December, 1922, sweet-cream prices stood in an entirely different relationship to whole-milk prices. During this period there was very little difference in the cost of cream when purchased in the form of whole milk and its cost when purchased from jobbers, the large surplus of milk having depressed the fluid price to an abnormally low level.

THE COURSE OF MILK PRICES

The course of milk prices in the Chicago dairy district for the last twenty years has not been unlike that in many other great city markets. From 1904 to 1915 the average annual increase was 4.7 cents a hundred pounds, or 3.4 percent of the average price for the period (Table 40). As is usually the case, milk prices lagged behind prices of other agri-

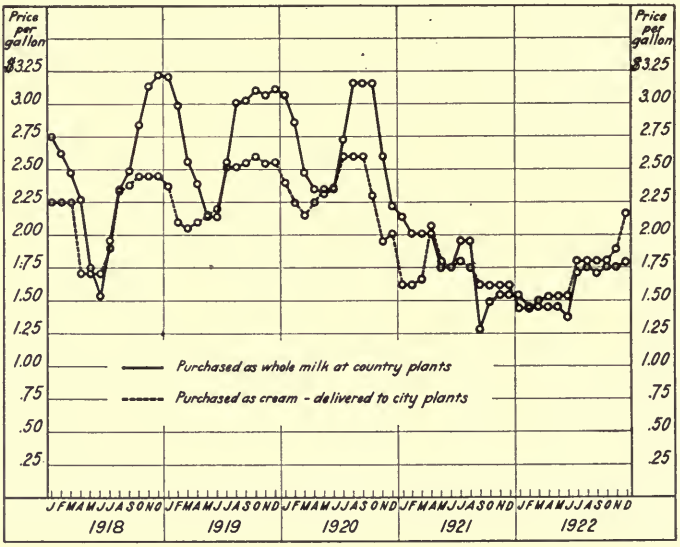

FIG. 14.—COMPARISON OF PRICE OF 36-PERCENT CREAM DELIVERED BY A JOBBER TO DISTRIBUTORS' CITY PLANTS AND COST OF AN EQUIVALENT AMOUNT OF CREAM PURCHASED AS WHOLE MILK AT COUNTRY PLANTS

Before 1921, distributors could buy cream from jobbers for less than they could buy whole milk and separate the cream, but as a result of the surplus production during 1921 and 1922 there was very little difference in cost in those years (85.4 pounds of 3.5-percent milk = 1 gallon of 36-percent cream).

cultural products and as a result the producers withheld their milk in April, 1916, until their demands for increased prices were met. The increase in price during the period September, 1915, to September, 1917, was fairly rapid (14.4 percent of the average), but not so great as that of feeds or grains. Consequently, the producers demanded and obtained a very large increase for October, 1917. This was followed by a period of high prices marked by indictments, the appointment of milk commissions, milk strikes, price fixing, and the formation of the Milk Producers Cooperative Marketing Company.

Prices broke in November, 1920, and in one year dropped to about half the previous level. This statement refers to the prices paid by dealers. Most of the milk was sold thru the marketing organization during 1919, 1920, and 1921, and after the administrative expenses and the loss on surplus were deducted, the producers received prices ranging from 50 to 99 percent of the prices paid by the dealers.[1] From November, 1921, to September, 1924, prices increased rapidly, and for the last year of the period averaged about 75 percent above the pre-war level.

TABLE 40.—TREND IN PRICES PAID BY DEALERS FOR 3.5-PERCENT MILK AT COUNTRY PLANTS IN CHICAGO DAIRY DISTRICT[a]

Yearly changes in price expressed in percentage of average price for period

Period	Number of years	Average annual change in price	
		cents	*perct.*
January, 1904–August, 1915	11.7	+4.7	+3.4
September, 1915–September, 1917	2.1	+26.7	+14.4
October, 1917–October, 1920	3.1	+16.7	+5.3
November, 1920–October, 1921	1.0	−113.5	−50.2
November, 1921–September, 1924	2.9	+37.3	+16.5

[a]Method of least squares.

ALTERNATIVE MARKETS FOR MILK

With the great surplus-milk region to the north of the Chicago dairy district, and with the slight cost necessary to divert this milk to the city market, the relative prices of milk used for various purposes are highly significant to the dairymen now supplying that market. If the Chicago price is maintained at an artificially high level, the Wisconsin farmers now selling to creameries, cheese factories, or condenseries will grasp the opportunity to share the advantages thus offered. If, on the other hand, the Chicago milk prices fall too low in relation to the prices offered for milk for other purposes, many dairymen in the district are so situated that one or more alternative markets are available. Tables 41 to 44 show the prices paid in these various markets during the ten-year period 1913 to 1922.

Condensery Market.—From 1913 to the middle of 1920, condensery prices, both in the inner and outer districts, averaged approximately the same as the Chicago fluid-milk price, but with the breakdown of export demand and the accumulation of unsold stocks, sharp price cuts were made. For 1920, 1921, and 1922 condensery prices were approximately 10 percent below the city price.

The seasonal variation in the price paid by near-by condenseries is very similar to that of the city fluid-milk price. The plants located just outside the Chicago district, however, pay prices which tend to be relatively higher in summer and lower in winter.

[1]Table A, Appendix.

Foreign-Type Cheese Factories.—During this ten-year period milk for the manufacture of foreign-type cheese brought a little over 80

TABLE 41.—AVERAGE PRICES OF 3.5-PERCENT MILK AT COUNTRY PLANTS IN THE CHICAGO TERRITORY

Year	Fluid milk for Chicago market	Av. of 6 condenseries in Chicago district	Av. of 9 condenseries outside Chicago district	Av. of 3 foreign-type cheese factories	Av. of 3 American cheese factories	[b]Value of butter-fat and skim milk
1913.....	$1.57	$1.57	$1.59	$1.31[a]	$.....	$1.30
1914.....	1.60	1.58	1.57	1.12[a]	.....	1.23
1915.....	1.58	1.55	1.48	1.25[a]	.....	1.21
1916.....	1.72	1.72	1.71	1.75[a]	1.60	1.43
1917.....	2.37	2.43	2.44	2.20[a]	2.08	1.90
1918.....	2.87	2.87	2.88	2.50	2.37	2.32
1919.....	3.25	3.25	3.27	2.61	2.62	2.66
1920.....	3.17	2.94	2.84	2.17	2.22	2.64
1921.....	2.09	1.87	1.74	1.57	1.55	1.71
1922.....	1.87	1.69	1.67	1.58	1.66	1.65
10-year average..	$2.21	$2.15	$2.12	$1.81	.....	$1.81

Acknowledgment is due Mr. V. R. Wertz, Assistant Professor of Agricultural Economics at the State Agricultural College of South Dakota, for his courtesy in furnishing the cheese factory prices and part of the condensery prices.

See Tables A, G, H, I, J, and K, Appendix, for monthly prices.

[a]Nine-month average, April to December.

[b]Butterfat prices are for sour cream delivered at Chicago, and skim milk is based on the wholesale price of tankage (10 pounds of skim milk = 1 pound of tankage).

TABLE 42.—COMPARISON OF PRICES PAID PRODUCERS FOR MILK USED IN VARIOUS WAYS IN THE CHICAGO TERRITORY

Year	Percentage of Chicago fluid-milk price					
	Chicago fluid-milk market	Condenseries in Chicago district	Condenseries outside Chicago district	Foreign-type cheese factories	American cheese factories	Value of butterfat and skim milk
1913.....	100.0	100.0	101.3	85.6[a]	.....	82.8
1914.....	100.0	98.8	98.1	72.7[a]	.....	76.9
1915.....	100.0	98.1	93.7	81.7[a]	.....	76.6
1916.....	100.0	100.0	99.4	97.7[a]	93.0	83.1
1917.....	100.0	102.5	103.0	87.6[a]	87.8	80.2
1918.....	100.0	100.0	100.3	87.1	82.6	80.8
1919.....	100.0	100.0	100.6	80.3	80.6	81.8
1920.....	100.0	92.7	89.6	68.5	70.0	83.2
1921.....	100.0	89.5	83.3	75.1	74.2	81.8
1922.....	100.0	90.4	89.3	84.5	88.8	88.2
10-year average..	100.0	97.3	95.9	81.9	81.5[b]	81.9

[a]Nine-month average, April to December, for both fluid-milk and cheese-factory prices; 12-month average for other years.

[b]Seven-year average, 1916 to 1922.

percent of the Chicago price. The different years show wide variations, ranging from 97.7 percent in 1916 to 68.5 percent in 1920.

This market is not ordinarily a year-round market, because of the difficulty of making good foreign-type cheese in the winter. Milk of

TABLE 43.—AVERAGE MONTHLY PRICES OF 3.5-PERCENT MILK AT COUNTRY PLANTS IN THE CHICAGO TERRITORY FOR THE TEN-YEAR PERIOD 1913 TO 1922

Month	Fluid milk for Chicago market	Av. of 6 condenseries in Chicago district	Av. of 9 condenseries outside Chicago district	Av. of 3 foreign-type cheese factories	[a]Av. of 3 American cheese factories	[b]Value of butterfat and skim milk
January..	$2.43	$2.37	$2.33	$....	$2.26	$1.85
February.	2.29	2.25	2.21	....	2.03	1.78
March...	2.13	2.09	2.09	....	1.89	1.84
April.....	2.08	2.02	2.02	1.46	1.66	1.82
May.....	1.82	1.79	1.84	1.67	1.68	1.66
June.....	1.69	1.65	1.72	1.65	1.65	1.62
July.....	2.05	1.96	1.93	1.71	1.72	1.66
August...	2.29	2.19	2.11	1.81	1.82	1.69
September	2.23	2.22	2.17	2.06	2.11	1.82
October..	2.51	2.38	2.27	2.07	2.35	1.91
November	2.52	2.42	2.36	2.14	2.53	1.99
December	2.49	2.46	2.38	2.05	2.48	2.03
Average..	$2.21	$2.15	$2.12	.....	.....	$1.81

[a]Seven-year average, 1916 to 1922.
[b]Butterfat prices are for sour cream delivered at Chicago and skim milk is based on the wholesale price of tankage (10 pounds of skim milk = 1 pound of tankage).

TABLE 44.—COMPARISON OF AVERAGE MONTHLY PRICES PAID PRODUCERS FOR MILK USED IN VARIOUS WAYS IN THE CHICAGO TERRITORY FOR THE TEN-YEAR PERIOD 1913 TO 1922

Month	Percentage of Chicago fluid-milk price					
	Chicago fluid-milk market	Condenseries in Chicago district	Condenseries outside Chicago district	Foreign-type cheese factories	[a]American cheese factories	Value of butterfat and skim milk
January..	100.0	97.5	95.9	.....	84.3	76.1
February.	100.0	98.3	96.5	.....	80.2	77.7
March...	100.0	98.1	98.1	.....	80.8	86.4
April.....	100.0	97.1	97.1	70.2	71.2	87.5
May.....	100.0	98.4	101.1	91.8	81.6	91.2
June.....	100.0	97.6	101.8	97.6	85.1	95.9
July.....	100.0	95.6	94.1	83.4	73.2	81.0
August...	100.0	95.6	92.1	79.0	69.5	73.8
September	100.0	99.6	97.3	92.4	83.7	81.6
October..	100.0	94.8	90.4	82.5	83.3	76.1
November	100.0	96.0	93.7	84.9	90.7	79.0
December	100.0	98.8	95.6	82.3	90.2	81.5
Average..	100.0	97.3	95.9	84.5[b]	81.5	81.9

[a]Seven-year average, 1916 to 1922.
[b]Nine-month average, April to December.

exceptionally high quality from grass-fed, spring-freshening cows is necessary for the best results. Many factories require their patrons to deliver the milk twice daily during the spring and summer. In winter many factories close while others manufacture American-type cheese.

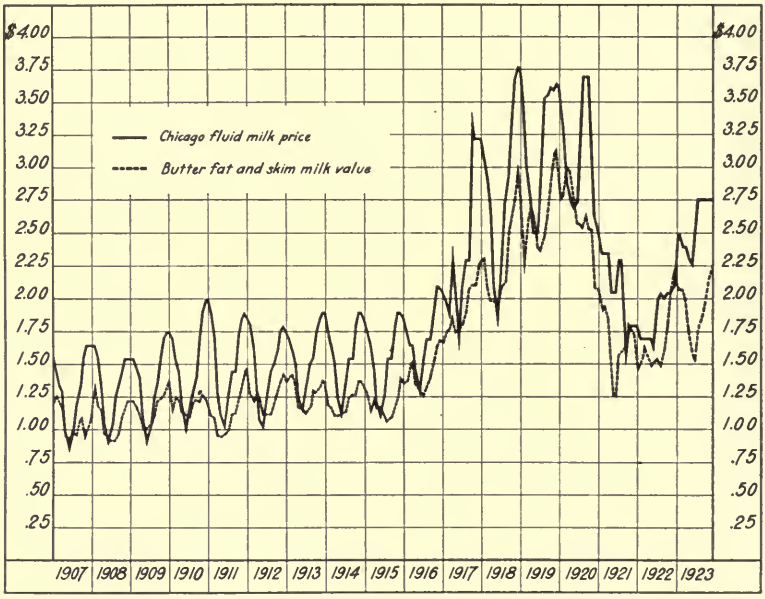

FIG. 15.—COMPARISON OF PRICE OF WHOLE MILK AT COUNTRY STATIONS AND VALUE OF AN EQUIVALENT AMOUNT OF WHOLE MILK IN TERMS OF BUTTERFAT AND SKIM MILK

Butterfat prices are for sour cream delivered at Chicago and skim milk is based on the wholesale price of tankage (10 pounds of skim milk = 1 pound of tankage). Since butter can be easily stored and milk cannot, the winter price for fat is relatively lower than the price for fluid milk. During the spring the large amount of milk produced forces the fluid-milk price to approximately the butterfat and skim-milk level. (See Tables A and K, Appendix, for monthly values.)

The foreign-type cheese region offers a good field for the extension of the Chicago dairy district, if the late summer shortage is to be met by bringing in milk from outside the territory rather than by changing the seasonal production of the inner district.

American Cheese Factories.—Price data were available for seven years only on these plants. During that time, the prices paid for milk were approximately the same as those paid by the foreign-type cheese factories. In the past, many American cheese factories closed in the winter, but the increase in the number of silos has caused a shift in the season of production. Relatively more cheese is now produced during the winter than formerly even with the higher cost of barn feeding.

Butterfat Market.—Practically every farmer in the Chicago district and in the contiguous territory has a butterfat market for his cream. This may be a local cooperative or proprietary creamery, a centralizer cream station, or, at least, a railway station from which he

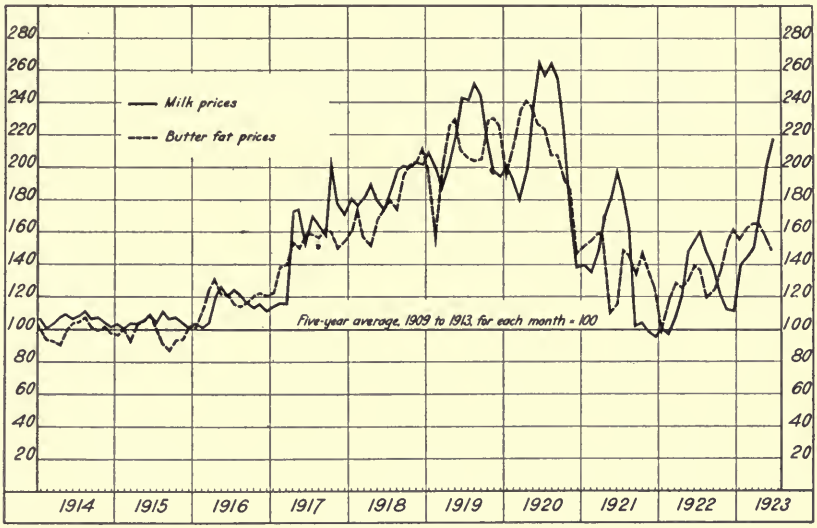

FIG. 16.—COMPARISON OF WHOLE MILK AND BUTTERFAT PRICES FOR TEN YEARS, 1914 TO 1923, BY USE OF INDEX NUMBERS

The Chicago fluid-milk price is greatly affected by butter prices because of the great surplus-milk producing region adjoining the district. Altho minor fluctuations and seasonal variations may be unlike, the long-time trends of both butter and fluid-milk prices are very similar. (See Tables C and L, Appendix, for monthly index numbers.)

can send his cream to a direct-shipment centralizer. Frequently all these markets are available.

The prices received are normally lower than for milk in other forms. To offset this disadvantage, the producer has the skim milk for feeding young stock, hogs, and poultry, he is not required to make as frequent deliveries, and he has less work and expense than if he were producing milk under city health regulations.

After an allowance for the feeding value of skim milk is added to the butterfat price, the butterfat market is seen to have paid slightly over 80 percent of the Chicago milk price during the ten-year period under consideration. The range was from 76.6 percent to 88.2 percent. The relatively high price for fat occurred in 1922, when fluid-milk prices were at an abnormally low level.

The winter prices for butterfat are relatively much lower than the summer prices. In other words, the fluid-milk price falls almost to the

butterfat and skim-milk value during the season of heaviest production. This is illustrated by Fig. 15, which shows the value of 100 pounds of milk on the two markets from 1907 to 1923.

The chart indicates, also, that fluid-milk prices in the Chicago district are closely linked with butterfat prices. This is illustrated better by Fig. 16, which shows index numbers of the two prices. Minor fluctuations and seasonal variations may be unlike, but the long-time trends are very similar. From the standpoint of alternative markets, this is to be expected, particularly when it is remembered that the great surplus region of Wisconsin borders the Chicago district.

PRICE DETERMINATION

No matter what plan of price determination is used in the Chicago district, it seems obvious that the city fluid-milk price must always be considered in relation to the prices of other dairy products for three reasons:

1. During certain seasons a very large proportion of the milk purchased for the city market must be utilized for other dairy products.

2. The city market is normally the most desirable. Dairymen selling to the lower-paying markets are always glad, therefore, to divert their milk to the city if prices are sufficient to overcome the obstacles of distance and to pay for the extra work entailed.

3. Conversely, unless the city fluid-milk price is high enough to pay for the additional care which is necessary, dairymen will shift to one of the markets with less-exacting requirements.

The writer offers no "rule of thumb" method of price-making, but suggests consideration of the following factors in arriving at prices:

1. *Amount of Surplus Milk.*—If the fluid-milk trade utilizes most of the supply or, as it is commonly expressed, "cleans up the market," an increase in price may be justified. If, however, the surplus is accumulating, an increase in price usually results in serious difficulties which a constant or decreased price would have prevented.

2. *Prices of Other Dairy Products.*—Because of the great surplus-producing region adjoining the Chicago dairy district, the importance of this factor in determining the price of milk cannot be too strongly emphasized. It has been discussed fully in the preceding pages.

3. *Cost of Feed and Labor.*—Since feed and labor make up the greater part of the cost of producing milk, changes in the cost of these two items should be carefully noted because of their influence on the probable supply of milk. Failure to do this in 1916, 1917, and 1918 resulted in a shortage of milk. Conversely, declining feed and labor costs, without an equivalent decrease in price, result in over-production.

4. *Pasture Conditions.*—Climatic conditions which cause either abundant or short pasturage may necessitate temporary price adjustments during the summer.

5. *Trend in the Production of Milk per Farm.*—The average production of milk per farm as shown by dealers' monthly purchase records, is a good indication whether producers consider prices equitable. When prices are favorable, production increases; when prices are low, production falls. Full advantage cannot be taken of this factor, however, because of the natural lag in farm practice. When prices are too high, production responds more quickly than when they are too low, because dairymen tend to buy additional cows more readily than they tend to sell a part of the herd. Abnormal pasture conditions may also cause variations in the production per farm and thus affect the accuracy of this measure.

6. *Trend of Consumption.*—Changes in consumption indicate to some extent the consumers' views as to the equitableness of retail milk prices. The value of this factor is lessened, however, because of the inelasticity of demand, altho milk prices that are too high are likely to cause a significant decline in consumption.

7. *Relative Profitableness of Other Farm Enterprises.*—Since other livestock enterprises and crops compete with dairying for land and labor, any great differences in the profits of the various enterprises will cause shifts from one to the other, thus affecting the supply of milk. Such changes, however, usually require considerable time in which to operate and are valuable only as a long-time guide to prices.

8. *Trend in the Raising of Young Stock.*—Another long-time measure of the proper adjustment of milk prices is the tendency of dairymen to increase or decrease the raising of heifer calves in response to profitable or unprofitable conditions. A permanent change in farm practice, however, should not be confused with maladjustment of price. Such a change is illustrated by the growing tendency of dairymen in the most intensive districts to maintain their herds by purchase rather than by raising young stock.

Careful attention to the above factors in price determination and good judgment in their application would do much to stabilize dairying in the Chicago district, by avoiding price maladjustments and the resulting periods of over- and underproduction.

CONCLUSIONS

The greater part of Chicago's milk supply comes from regions in northern Illinois and southern Wisconsin, where a large proportion of the land is tillable. Crop-growing competes with dairying for labor and this, together with the relatively high winter prices for milk which prevailed until 1919, has resulted in the overdevelopment of winter dairying, while not enough milk is produced in late summer and early fall.

Since 1919 summer prices have been maintained at relatively higher levels in an effort to stimulate production during the summer,

but with practically no effect on seasonal production in the inner part of the district. It appears quite probable that before these high summer prices have changed the seasonal production to any extent, large amounts of milk will be attracted to the city market from the summer dairying regions of Wisconsin. Perhaps, in the long run, the most economical method of obtaining a relatively uniform supply thruout the year will be to pay winter prices that are high enough to encourage winter dairying in the inner district, where crop-growing is a major enterprise, and to supplement the low summer production by bringing in milk from the surplus-producing regions of Wisconsin, where a smaller proportion of the land is tillable.

The demand for dairy products varies with the season, the day of the week, and the temperature. These variations are fairly definite and can therefore be predicted. Nevertheless, these whims of consumption tend to increase the cost of handling milk and the price the consumer pays must necessarily cover this cost. Altho changes in the retail prices of pints and quarts of milk cause consumers to shift from one unit to the other and to increase or decrease the demand, the net change in consumption is very small, indicating that there is very little elasticity in the demand for milk.

During the period considered in this study, the amount of surplus milk has been rapidly increasing. The large dealers have been bearing a greater part of the surplus burden than the small dealers. Since the former group constitutes the more important element in the demand side in bargaining with the producers, this surplus has a very great influence on milk prices. It is especially unfortunate that a large amount of surplus milk comes in the winter, when production costs are high. There is a certain amount of surplus that must be carried at all times because of the variability of supply and demand, but this necessary surplus is a cost of the business and should not unduly influence prices.

Altho the producers in the present Chicago dairy district will, in all probability, hold their own in competition with the great surplus-producing region to the north, they will meet with serious difficulties in keeping their market unless they take this available supply into consideration in bargaining with the dealers. In spite of the often expressed wish of the Chicago producers to "build a wall around the Chicago dairy district," the dairymen in the surplus-producing regions will always be potential competitors. Because of this fact, a city fluid-milk price that is out of line with prices of other dairy products cannot be maintained for any length of time. Hence, if producers in the Chicago district are to further their own interests, they must use care not to force fluid-milk prices to a point where dairymen in the surplus region will be induced to seek the Chicago market.

APPENDIX

TABLE A.—AVERAGE PRICE PAID BY DEALERS FOR MILK AT COUNTRY PLANTS IN THE CHICAGO DAIRY DISTRICT[a]

Per 100 pounds of 3.5-percent milk

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
1907.....	$1.55	$1.45	$1.35	$1.30	$1.00	$ .90	$1.00	$1.20	$1.30	$1.55	$1.65	$1.65	$1.33
1908.....	1.65	1.65	1.55	1.35	1.05	.95	1.05	1.25	1.35	1.45	1.55	1.55	1.37
1909.....	1.55	1.55	1.45	1.40	1.10	.95	1.05	1.25	1.35	1.55	1.70	1.75	1.39
1910.....	1.75	1.70	1.55	1.45	1.20	1.05	1.20	1.30	1.40	1.70	1.90	2.00	1.52
1911.....	2.00	1.90	1.70	1.30	1.10	1.00	1.30	1.45	1.45	1.70	1.85	1.90	1.55
1912.....	1.85	1.80	1.65	1.30	1.05	1.00	1.30	1.45	1.50	1.60	1.75	1.80	1.50
1913.....	1.75	1.70	1.60	1.50	1.25	1.15	1.35	1.50	1.55	1.75	1.85	1.90	1.57
1914.....	1.90	1.75	1.65	1.50	1.25	1.10	1.35	1.55	1.55	1.80	1.90	1.90	1.60
1915.....	1.85	1.75	1.65	1.45	1.20	1.10	1.30	1.55	1.55	1.80	1.90	1.90	1.58
1916.....	1.85	1.75	1.65	1.65	1.45	1.25	1.55	1.70	1.70	1.90	2.10	2.10	1.72
1917.....	2.05	2.00	1.85	2.40	2.00	1.60	2.12	2.30	2.30	3.42	3.22	3.22	2.37
1918.....	3.22	3.07	2.90	2.65	2.05	1.80	2.30	2.75	2.92	3.32	3.68	3.77	2.87
1919.....	3.76	3.50	3.00	2.80	2.50	2.50	3.00	3.52	3.55	3.63	3.60	3.65	3.25
1920.....	3.60	3.35	2.90	2.75	2.70	2.75	3.20	3.70	3.70	3.70	3.05	2.60	3.17
1921.....	2.50	2.35	2.35	2.35	2.05	2.05	2.30	2.30	1.50	1.75	1.80	1.80	2.09
1922.....	1.80	1.70	1.70	1.70	1.70	1.60	2.00	2.05	2.00	2.05	2.05	2.10	1.87
1923.....	2.50	2.50	2.40	2.40	2.30	2.25	2.75	2.75	2.75	2.75	2.75	2.75	2.57
1924.....	2.675	2.675	2.675	2.50	2.30	2.30	2.50	2.60	2.60	2.40	2.40	2.40	2.50

[a]Up to April 1, 1913, flat price paid for milk of any test.

April 1, 1913, to October 1, 1915, 2 cents per point paid for milk testing above 3.7 percent; for milk testing below 3.6 percent, 2 cents per point deducted.

October 1, 1915, to April 1, 1916, difference of 3 cents per point up or down made on 3.6-percent base.

April 1, 1916, to July 1, 1918, difference of 3 cents per point up or down made on 3.5-percent base.

July 1, 1918, to December 31, 1924, difference of 4 cents per point up or down made on 3.5-percent base.

From January, 1919, to October, 1921, the dealers paid the Milk Producers Cooperative Marketing Company agreed prices. After deducting the administrative expenses and loss on surplus, the Marketing Company paid the following prices to producers:

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
1919.....	$3.72	$3.46	$2.97	$2.77	$2.42	$2.42	$2.97	$3.48	$3.51	$3.59	$3.56	$3.61	$3.21
1920.....	3.56	3.28	2.75	2.61	2.62	2.67	3.10	3.51	3.33	3.33	2.74	2.34	2.99
1921.....	2.25	2.11	2.11	2.11	1.02	1.84	1.84	2.07	1.35	1.57	(b)	(b)	

[b]Milk checks for November and December, 1921, were held up. The Company discontinued business, and when reorganized gave bonds to cover these two months.

TABLE B.—RETAIL PRICES OF MILK AND CREAM ON DELIVERY ROUTES IN CHICAGO

Date prices became effective	Quarts of milk	Pints of milk	Half-pints of 22-percent cream	Half-pints of 32-percent cream	Quarts of buttermilk
	cents	*cents*	*cents*	*cents*	*cents*
January 1, 1902	7	4	9	..	..
November 1, 1907	8	4	9	..	..
February 1, 1908	7	4	9	..	..
November 1, 1909	8	5	10	12	5
August 1, 1916	9	5	10	12	5
April 3, 1917	10	6	12	14	7
October 1, 1917	13	7	15	18	9
November 1, 1917	12	7	15	18	9
August 1, 1918	12.5	7	15	18	9
September 1, 1918	13	8	15	18	9
November 1, 1918	14	8	15	18	10
March 1, 1919	13	8	15	18	10
May 20, 1919	14	8	15	18	10
August 1, 1919	15	9	16	20	10
March 1, 1920	14	9	16	20	10
July 1, 1920	15	9	17	22	10
August 5, 1920	16	10	17	22	10
November 1, 1920	15	9	17	22	10
December 1, 1920	14	9	17	22	10
February 1, 1921	14	8	17	22	10
September 1, 1921	12	7	16	21	10
December 1, 1922	12	8	16	21	10
January 8, 1923	13	8	16	21	10
July 1, 1923	14	8			

TABLE C.—INDEX NUMBERS OF PRICES PAID BY DEALERS FOR 3.5-PERCENT MILK AT COUNTRY PLANTS IN THE CHICAGO DAIRY DISTRICT

Five-year average of each month (1909 to 1913) = 100

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1907	...	...	...	94	88	87	81	86	90	93	91	88
1908	93	95	97	97	92	92	85	90	93	87	86	83
1909	87	90	91	101	96	92	85	90	93	93	94	94
1910	98	98	97	104	105	102	97	94	97	102	105	107
1911	112	110	107	94	96	97	105	104	100	102	102	102
1912	104	104	104	94	92	97	105	104	103	96	97	96
1913	98	98	101	108	110	112	109	108	107	105	102	102
1914	107	101	104	108	110	107	109	112	107	108	105	102
1915	104	101	104	104	105	107	105	112	107	108	105	102
1916	104	101	104	119	127	121	125	122	117	114	116	112
1917	115	116	116	173	175	155	171	165	159	206	178	172
1918	181	177	182	191	180	175	185	198	201	200	203	202
1919	211	202	189	201	219	243	242	253	245	219	199	195
1920	202	194	182	198	237	267	258	266	255	223	169	139
1921	140	136	148	169	180	199	185	165	103	105	99	96
1922	101	98	107	122	149	155	161	147	138	123	113	112
1923	140	145	151	173	202	218	222	198	190	166	152	147
1924	150	155	168	180	202	223	202	179	174	145	133	128

TABLE D.—INDEX NUMBERS OF THE DEALERS' MARGIN BETWEEN RETAIL PRICE PER QUART OF MILK AND PRICE PAID TO PRODUCERS AT COUNTRY PLANTS IN THE CHICAGO DAIRY DISTRICT

Five-year average of each month (1909 to 1913) = 100

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1903	96	94	95	92	92	94	96	97	95	98	93	91
1904	91	92	93	92	94	96	98	97	95	100	98	93
1905	94	99	97	92	94	96	98	97	95	100	98	96
1906	96	99	97	92	94	96	98	97	95	98	93	91
1907	91	94	95	88	90	90	94	92	91	86	108	111
1908	112	84	83	86	88	88	92	90	88	91	88	91
1909	91	89	88	84	86	88	92	90	88	86	105	106
1910	107	106	106	100	102	103	105	109	108	103	96	93
1911	94	97	100	109	105	105	102	101	103	103	98	98
1912	102	101	102	109	107	105	102	101	101	108	103	104
1913	107	106	104	98	100	99	100	99	99	100	98	98
1914	99	104	102	98	100	101	100	97	99	98	96	98
1915	102	104	102	100	102	101	102	97	99	98	96	98
1916	102	104	102	92	90	96	90	111	114	117	108	111
1917	114	116	116	100	107	117	105	105	108	134	123	126
1918	127	131	132	130	141	146	137	137	144	139	147	146
1919	147	158	150	144	143	155	146	153	157	170	176	179
1920	183	191	178	167	152	144	156	168	172	191	206	210
1921	218	220	206	186	179	171	176	189	188	196	199	205
1922	206	205	192	174	156	153	150	158	166	179	184	187
1923	193	188	181	163	150	146	156	168	172	191	196	202
1924	208	203	190	180	171	164	168	176	181	211	216	224

TABLE E.—NUMBER OF BOTTLES HANDLED MONTHLY BY MILK DEALERS' BOTTLE EXCHANGE DURING THE THREE YEARS 1920, 1921, 1922

Month	1920		1921		1922	
	Received at Exchange	Delivered to dealers	Received at Exchange	Delivered to dealers	Received at Exchange	Delivered to dealers
January	15 134	396	906 340	731 107	1 394 358	1 387 375
February	701 998	746 070	1 067 370	1 125 705	1 332 765	1 063 113
March	983 313	964 789	1 081 475	1 050 813	1 636 239	1 662 729
April	972 768	993 933	1 264 913	1 320 524	1 579 322	1 548 322
May	1 034 200	1 054 614	1 254 921	1 266 921	2 741 640	2 372 003
June	1 075 679	1 037 799	1 481 560	1 411 453	2 748 440	2 875 033
July	1 157 637	1 190 060	1 469 342	1 416 471	3 187 055	3 296 762
August	1 236 974	1 369 230	1 717 854	1 736 563	3 149 822	3 213 619
September	1 203 474	1 316 010	1 604 333	1 729 599	2 812 106	2 752 069
October	1 138 327	1 212 207	1 501 797	1 521 357	2 933 309	3 017 567
November	799 222	822 247	1 472 580	1 499 641	2 508 658	2 685 025
December	821 354	887 596	1 376 223	1 424 110	2 107 479	2 247 538
Total	11 140 080	11 594 951	16 198 708	16 234 264	28 131 193	28 121 155

TABLE F.—RELATIVE CONSUMPTION OF PINTS AND QUARTS OF MILK IN DIFFERENT PARTS OF CHICAGO, BY MONTHS

Based on average retail sales during the three-year period 1920 to 1922

Month	Pints of milk consumed for each 100 quarts							
	Section A	Section B	Section C	Section D	Section E	Oak Park	Evanston	All Chicago and suburbs
January....	15.4	22.1	20.9	33.5	22.1	17.7	13.9	25.1
February...	15.2	22.2	21.2	34.3	22.1	17.8	14.0	25.7
March.....	14.6	21.8	20.9	34.9	15.2	17.1	14.3	26.0
April.....	15.3	22.9	21.8	36.3	25.7	17.8	14.9	27.0
May.....	16.6	24.7	23.0	39.1	23.7	18.8	15.6	28.8
June.....	17.9	26.7	25.6	42.6	25.3	20.5	17.1	31.8
July.....	18.6	27.6	26.4	46.4	26.5	21.6	18.5	32.8
August.....	18.9	27.7	27.4	48.1	26.8	21.9	19.0	33.7
September..	17.7	26.2	25.9	44.1	18.6	20.1	17.6	31.2
October....	17.1	25.3	24.9	41.0	18.1	19.5	16.9	29.9
November..	16.6	24.4	24.3	39.1	23.9	19.0	16.2	29.0
December..	13.9	20.9	19.7	32.8	20.4	16.0	13.7	24.1
Total....	16.5	24.3	23.5	39.2	23.7	18.9	15.9	28.9

TABLE G.—AVERAGE PRICE PAID TO PRODUCERS BY SIX CONDENSERIES LOCATED IN THE CHICAGO DAIRY DISTRICT[a]

Per 100 pounds of 3.5-percent milk

Month	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	10-yr. aver.
January	$1.79	$1.88	$1.84	$1.80	$2.10	$3.24	$3.76	$3.60	$2.11	$1.57	$2.37
February	1.70	1.77	1.76	1.71	2.09	3.10	3.47	3.35	2.09	1.45	2.25
March	1.61	1.67	1.67	1.62	2.00	2.91	3.02	2.86	2.06	1.45	2.09
April	1.53	1.47	1.47	1.64	2.40	2.62	2.80	2.75	2.08	1.44	2.02
May	1.30	1.22	1.22	1.47	2.06	2.06	2.50	2.70	1.90	1.44	1.79
June	1.16	1.10	1.10	1.28	1.71	1.82	2.53	2.75	1.64	1.44	1.65
July	1.38	1.36	1.32	1.54	2.17	2.30	3.00	3.20	1.65	1.67	1.96
August	1.50	1.50	1.49	1.69	2.33	2.75	3.52	3.49	1.84	1.79	2.19
September	1.56	1.51	1.51	1.72	2.39	2.92	3.55	3.44	1.78	1.81	2.22
October	1.68	1.76	1.68	1.94	3.41	3.32	3.63	2.66	1.78	1.89	2.38
November	1.79	1.84	1.78	2.08	3.24	3.68	3.60	2.28	1.80	2.06	2.42
December	1.88	1.86	1.80	2.13	3.24	3.77	3.65	2.19	1.76	2.31	2.46
Average	$1.57	$1.58	$1.55	$1.72	$2.43	$2.87	$3.25	$2.94	$1.87	$1.69	$2.15

[a]Elgin and Belvidere, Illinois; Burlington, Monroe, New Glarus, and Sharon, Wisconsin.

TABLE H.—AVERAGE PRICE PAID TO PRODUCERS BY NINE CONDENSERIES LOCATED IN THE TERRITORY CONTIGUOUS TO THE CHICAGO DAIRY DISTRICT[a]

Per 100 pounds of 3.5-percent milk

Month	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	10-yr. aver.
January	$1.74	$1.82	$1.72	$1.73	$2.21	$3.22	$3.78	$3.62	$1.84	$1.60	$2.33
February	1.72	1.76	1.66	1.70	2.13	3.15	3.34	3.29	1.88	1.46	2.21
March	1.69	1.68	1.59	1.64	2.03	2.91	2.94	2.90	2.03	1.45	2.09
April	1.58	1.50	1.41	1.63	2.33	2.57	2.84	2.81	2.04	1.46	2.02
May	1.38	1.29	1.25	1.47	2.17	2.13	2.70	2.78	1.73	1.45	1.84
June	1.26	1.22	1.17	1.35	2.00	1.91	2.71	2.80	1.36	1.45	1.72
July	1.43	1.39	1.29	1.49	2.28	2.24	3.03	3.16	1.38	1.60	1.93
August	1.52	1.48	1.40	1.62	2.36	2.66	3.49	3.24	1.71	1.62	2.11
September	1.56	1.52	1.42	1.67	2.43	2.92	3.57	3.22	1.71	1.72	2.17
October	1.64	1.71	1.54	1.86	3.07	3.36	3.60	2.34	1.72	1.87	2.27
November	1.72	1.73	1.61	2.07	3.10	3.69	3.59	2.20	1.77	2.08	2.36
December	1.80	1.73	1.68	2.28	3.20	3.79	3.64	1.70	1.70	2.33	2.38
Average	$1.59	$1.57	$1.48	$1.71	$2.44	$2.88	$3.27	$2.84	$1.74	$1.67	$2.12

[a]Dixon, Orangeville, Sterling, and Union, Illinois; Berlin, Chilton, Johnson Creek, Richland Center, and Watertown, Wisconsin.

TABLE I.—AVERAGE PRICE PAID TO PRODUCERS BY THREE FOREIGN-TYPE CHEESE FACTORIES IN THE CHICAGO TERRITORY[a]

Per 100 pounds of 3.5-percent milk

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.[c]
1910.....	[b]	....	....	$1.06	$1.18	$1.32	$1.29	$1.18	$1.06	$1.13	$1.18	$1.03	$1.16
1911.....	....	....	....	.68	.66	.92	.91	.89	1.07	1.18	1.38	....	.96
1912.....	....	....	....	1.20	1.28	1.30	1.05	1.26	1.45	1.64	1.53	1.70	1.38
1913.....	....	....	....	1.23	1.32	1.17	1.16	1.20	1.20	1.34	1.51	1.65	1.31
1914.....	....	....	....	.82	1.00	1.00	1.34	1.00	1.07	1.23	1.30	1.30	1.12
1915.....	....	....	....	1.03	1.19	1.02	.95	1.11	1.29	1.54	1.61	1.52	1.25
1916.....	....	....	....	1.25	1.30	1.34	1.42	1.92	2.20	2.09	2.23	1.98	1.75
1917.....	....	....	....	1.81	1.74	1.77	1.83	2.21	2.59	2.49	2.67	2.65	2.20
1918.....	$2.36	$2.35	$1.65	1.69	1.97	2.21	2.65	2.72	3.21	3.03	3.20	2.90	2.50
1919.....	2.26	1.74	2.01	2.31	2.57	2.74	2.92	2.65	2.96	3.08	3.19	2.83	2.61
1920.....	2.50	2.22	2.18	2.16	2.49	2.28	2.01	2.21	2.39	1.96	1.99	1.70	2.17
1921.....	1.44	1.54	1.70	1.13	1.64	1.67	1.33	1.42	1.63	1.98	1.57	1.75	1.57
1922.....	1.26	1.16	1.04	1.17	1.46	1.35	1.48	1.62	2.09	1.97	2.10	2.21	1.58
1923.....	1.82	1.74	1.53	1.44	1.98	1.68	....	....	....	....	....	....	....

[a]Located in Dane, Green, and LaFayette counties, Wisconsin.
[b]Foreign cheese is ordinarily not manufactured during the winter months.
[c]Average prices are for the number of months given in the table.

TABLE J.—AVERAGE PRICE PAID TO PRODUCERS BY THREE AMERICAN CHEESE FACTORIES IN THE CHICAGO TERRITORY[a]

Per 100 pounds of 3.5-percent milk

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
1916.....	$1.63	$1.56	$1.37	$1.26	$1.21	$1.20	$1.16	$1.35	$1.72	$1.96	$2.55	$2.24	$1.60
1917.....	2.12	2.08	2.01	1.92	1.93	1.95	1.81	1.92	2.26	2.26	2.31	2.41	2.08
1918.....	2.39	2.28	1.81	1.62	1.66	1.78	1.88	2.06	2.73	3.22	3.52	3.44	2.37
1919.....	3.02	2.12	2.51	2.35	2.54	2.49	2.57	2.51	2.50	2.89	2.89	3.07	2.62
1920.....	2.86	2.42	2.41	2.28	2.18	1.86	1.84	1.99	2.25	2.12	2.37	2.03	2.22
1921.....	2.17	2.17	1.74	1.10	.93	.94	1.40	1.44	1.52	1.76	1.68	1.77	1.55
1922.....	1.63	1.56	1.40	1.08	1.29	1.36	1.36	1.45	1.79	2.25	2.38	2.42	1.66
1923.....	2.25	1.91	1.71	1.53	1.74	1.68	....	....	....	....	....	....	....

[a]Located in Iowa and Sheboygan counties, Wisconsin.

TABLE K.—VALUE OF 100 POUNDS OF 3.5-PERCENT MILK ON A BUTTERFAT AND SKIM MILK BASIS[a]

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
1907.....	$1.21	$1.27	$1.23	$1.18	$ .96	$ .94	$ .99	$ .98	$1.07	$1.11	$ .98	$1.06	$1.08
1908.....	1.22	1.36	1.19	1.16	.98	.96	.93	.93	.97	1.09	1.17	1.22	1.10
1909.....	1.23	1.22	1.17	1.10	1.01	1.02	1.05	1.10	1.22	1.24	1.27	1.34	1.16
1910.....	1.39	1.19	1.26	1.24	1.14	1.12	1.11	1.21	1.24	1.22	1.28	1.25	1.22
1911.....	1.19	1.11	1.10	.96	.96	.97	1.01	1.12	1.13	1.23	1.34	1.45	1.13
1912.....	1.49	1.29	1.24	1.30	1.24	1.13	1.13	1.12	1.20	1.27	1.37	1.44	1.27
1913.....	1.37	1.41	1.42	1.35	1.18	1.16	1.14	1.18	1.31	1.30	1.33	1.39	1.30
1914.....	1.36	1.19	1.17	1.11	1.11	1.13	1.14	1.25	1.27	1.28	1.37	1.37	1.23
1915.....	1.34	1.29	1.18	1.24	1.18	1.18	1.12	1.08	1.10	1.19	1.26	1.41	1.21
1916.....	1.36	1.38	1.50	1.53	1.32	1.29	1.25	1.32	1.43	1.51	1.63	1.69	1.43
1917.....	1.67	1.75	1.78	1.87	1.74	1.76	1.80	1.90	2.08	2.11	2.11	2.26	1.90
1918.....	2.30	2.31	2.09	1.99	1.99	2.00	2.07	2.13	2.49	2.64	2.78	3.01	2.32
1919.....	2.77	2.19	2.60	2.75	2.61	2.37	2.35	2.45	2.60	2.92	3.10	3.15	2.66
1920.....	2.77	2.81	3.01	2.98	2.71	2.57	2.56	2.53	2.66	2.53	2.51	2.09	2.64
1921.....	2.07	1.90	1.95	1.85	1.26	1.25	1.58	1.63	1.64	1.82	1.78	1.73	1.71
1922.....	1.44	1.53	1.65	1.56	1.47	1.51	1.54	1.47	1.60	1.78	2.05	2.24	1.65
1923.....	2.13	2.08	2.07	1.98	1.74	1.59	1.54	1.76	1.88	1.98	2.15	2.26	1.93
1924.....	2.19	2.06	1.93	1.59	1.49	1.56	....	....	....	....	....	....	....

[a]Butterfat prices are for sour cream delivered to a centralizer creamery in Chicago and skim milk is based on the wholesale price of tankage (10 pounds of skim milk = 1 pound of tankage).

TABLE L.—INDEX NUMBERS OF PRICES PAID FOR BUTTERFAT BY A CHICAGO CENTRALIZER CREAMERY[a]

Five-year average of each month (1909-1913 = 100)

Year	Jan.	Feb.	Mch.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1907	91	104	101	101	86	87	91	84	88	89	73	76
1908	91	112	97	98	88	89	85	80	78	87	89	89
1909	93	99	96	93	92	95	98	97	102	101	98	99
1910	107	96	103	106	104	106	104	108	103	97	97	90
1911	86	87	86	77	83	87	91	97	91	97	101	106
1912	112	104	99	109	113	105	103	97	97	101	104	105
1913	102	114	116	115	107	108	104	102	107	104	100	101
1914	101	94	93	91	100	104	105	108	102	100	102	98
1915	97	101	94	103	106	110	102	92	88	94	94	102
1916	101	111	124	132	122	122	116	115	117	121	123	121
1917	123	139	140	154	151	159	159	157	162	160	151	155
1918	161	176	157	153	168	174	180	175	195	202	204	213
1919	199	162	201	225	231	211	207	204	205	229	231	225
1920	198	216	235	242	237	227	224	208	208	193	186	148
1921	152	155	160	158	111	116	150	146	136	149	137	126
1922	102	118	128	126	131	140	137	121	125	138	154	163
1923	157	163	166	166	158	149	144	145	154	158	165	168
1924	169	171	160	135	140	151	...	...	...	...	...	...

[a]Sour cream delivered at the plant.

BOUND BY

UNIVERSITY OF ILLINOIS-URBANA
Q.630.7IL6B C002
BULLETIN. URBANA
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